Chapter 4

Results and Discussion

The data for the present research was collected at the pre-test condition, intervention provided and the effect of the therapy measured at the post-test condition. The data was tabulated and coded, following which relevant analyses was carried out. The results of the statistical analyses are discussed as follows:

Table 1

Demographic Distribution of the Sample

N=155

Demographic factor	Levels	N	Percentage
Age	Young adult (20-35 years)	29	18.71
	Middle adult (36-50 years)	85	54.84
	Older adult (51-65 years)	41	26.45
Education	Primary schooling	37	23.87
	High schooling	55	35.48
	Higher Secondary schooling	32	20.65
	Graduation	23	14.84
	Post Graduation	8	5.16
Occupation	Unemployed	17	10.97
	Daily wages	30	19.35
	Self employed	54	34.84

	Private employee	44	28.39
	Government employee	10	6.45
	Below Rs. 20,000/-	110	70.97
Income	Rs. 20,001/- to Rs. 50,000/-	24	15.48
	Rs. 50,001/- and above	21	13.55
	Unmarried	75	48.39
Marital Status	Married	76	49.03
	Divorced	4	2.58
	Less than 10 years	90	58.06
Years of drinking	10-20 years	46	29.68
	20 years and above	19	12.26

Table 1 shows the distribution of the sample across the Demographic Factors. Based on Age, 18.71% fall under the category of young adults (20-35 years), 54.84% fall under middle adults (36-50 years) and 26.45% fall under older adults (51-65 years). In terms of Education, 23.87% have completed primary schooling, 35.48% have completed high schooling, 20.65% have completed higher secondary schooling, 14,84% have graduated and 5.16% have completed post-graduation. On the Occupation, 10.97% are unemployed, 19.35% are daily wage workers, 34.84% are self-employed, 28.39% work in the private sector and 6.45% work in the government sector. In terms of the monthly Income, 70.97% fall under the lower strata earning Rs. 20,000/- or less, 15.48% earn between Rs. 20,000/- to Rs. 50,000 and 13.55% earn above Rs. 50,000/-. Out of the 155 individuals included in the study, 48.39% are unmarried, 49.03% are married and 2.58% divorced. Based on the Years of Drinking, 58.06% have been drinking for less than ten years, 29.68% have been drinking for ten to twenty years and 12.26% of the sample have been abusing alcohol for more than twenty years.

Owing to the large sample size being representative of the population (n>30), normality of data has been assumed based on the Central Limits Theorem (Lewis-Beck et al., 2004). According to this theorem, with an increase in sample size, the distribution of the sample approximates to a normal distribution even if the data in the population is not normal or skewed. Mordkoff (2000) has stated that assumption of normality refers to the normal distribution of the mean value of different independent sample, and not the data by itself, hence any set of data is considered as normally distributed. Due to the increased chances for the occurrence of Type I error and the robustness of the t-test analysis, the need of testing for normality in clinical research is turned down (Rochon et al., 2012). Similar findings have been established in the case of the paired sample t-test also (Rasch et al., 2009).

Table 2

Cognitive Abilities of People with AUD before Intervention

(N=155)

Cognitive Ability	Mean	Standard Error of Mean	Median	Standard Deviation
Verbal Fluency	5.93	0.225	6.00	2.806
Categorical Fluency	7.65	0.200	7.00	2.488
Attention	93.40	3.144	86.00	39.141
Working Memory	5.88	0.143	6.00	1.780
Fine Motor Skills	262.86	3.586	258.00	44.640
Reaction Time	970.06	10.376	942.00	129.176
Perceptual Speed	31.91	1.121	31.00	13.952
Perceptual Accuracy	57.90	1.120	59.00	13.947

Table 2 shows the Cognitive Abilities of People with AUD in the pre-test condition, measuring their abilities as an effect of the alcohol over-use. The Cognitive Abilities of the sample are tabulated in terms of the Mean and Standard Deviation values.

On Verbal Fluency, the sample have scored a mean of 5.93 implying that they were able to recall 6 words per minute on an average whereas on Categorical Fluency they have scored a mean of 7.65, showing that they recalled 8 words per minute on an average. This ability on fluency exhibited by the sample is similar to the ability of people in the elderly group above the age of 70 (Thapliyal et al., 2016), thus indicating presence of deficit in the Verbal and Categorical Fluency of people with AUD.

In order to perform well on a task of fluency, it is essential that the pre-frontal cortex of the individual is intact (Schwartz & Baldo, 2001). Fluency is found to be closely related to fluid intelligence (Roca et al., 2012), with abilities to process information, retain the instructions in the working memory (Rende et al., 2002), be able to initiate relevant responses and suppress the irrelevant words that arises in their consciousness (Hirshorn & Thompson-Schill, 2006), so as to perform efficiently on a fluency task.

Though Verbal and Categorical Fluency may be paired together as a measure of one's language ability, they show variations in the retrieval process. A verbal fluency task requires an individual to recall words based on the phonemic sound of the word whereas categorical recall is often cued by association between related words belonging to the same class (Luo et al., 2010; Katzev et al., 2013). Hence, individuals have shown differences in their abilities of Verbal and Categorical Fluency (Henry & Crawford, 2004), as indicated by the mean scores.

The differences in the verbal and categorical fluency are attributed to the localized areas of the brain responsible for the two activities. Verbal Fluency is associated with the posterior-dorsal, left-inferior frontal gyrus whereas Categorical Fluency is associated with the anterior-ventral, left-inferior frontal gyrus (Robinson et al., 2012). Hence it is considered that the Categorical Fluency is more a reflection of the verbal ability, whereas the phonemic fluency is more associated with the executive ability of an individual (Shao et al., 2014), therefore indicating better verbal ability in the sample than executive ability.

People with AUD are found to have increased blood flow in the left, central and right areas of the inferior frontal gyrus, hence causing damage to the neuronal cells in those regions of the brain (Kong et al., 2019), providing evidence for the above stated lack of ability in relation to fluency. A review of literature of the past studies states that damage to the frontal lobe of the brain can be identified both through neuro-imaging techniques and through the deficits in functioning related to the frontal lobe exhibited in the respective cognitive and personality shortfalls (Moselhy et al., 2001).

In the present study, the variable Attention is measured by the time taken to complete the Trail-making Task (Part-A). The number of seconds required to complete the task is considered as the measure of Attention ability. As indicated by the mean score, the sample have completed

the task in about 93.40 seconds, which is indicative of low ability. An adult who is in a state of good Cognitive health is found to complete the same task in about 75.38 seconds (Bhatia et al., 2007), showing a gap of ~20 seconds in the sample being studied.

Attention is a basic ability, an activity necessary to carry out all other cognitive functions, both in domains of perception and processing of information. The initiation of attention involves a separate pathway in the brain, based on the sensation received. The subsequent activity which processes the stimuli to make decisions and elicit output involves different pathways (Posner, 2012). Attending to new stimuli was found to produce neuronal activity in the lateral frontal and parietal regions during the beginning of the attention process. The medial frontal, anterior cingulate and bilateral anterior insular areas of the brain help sustenance of attention (Dosenbach et al., 2006).

In people with AUD, continuous consumption of alcohol leads to the accumulation of acetaldehyde in the brain, leading to alkaloid condensation in the neuronal cells (Deng & Deitrich, 2008). This in turn is found to affect the neurotransmitters such as acetylcholine in the brain (Tarren et al., 2016) and GABA in the spinal cord (Banerjee, 2014). In addition, the calcium-activated potassium channels are disrupted under the influence of alcohol (Brodie et al., 2007). These changes in the brain cause slowdown of neuronal activation, resulting in suppression of the attentional process (Sullivan et al., 2010), reflected by the increased time taken to complete the task measuring attention.

Working Memory is a cognitive ability related to attention, on which the sample have recalled ~6 chunks of numbers on an average, as shown by the mean of 5.88. Research states evidence for overlap in activation of the frontal lobe during activities of both attention and working memory (Lepsien & Nobre, 2006). Attending to stimuli from the external environment requires bottom-up process of information, whereas recall from the immediate or remote memory involves the top-down process. Both these activities are found to cause activation in the fronto-parietal neural networks, thereby explaining the relationship between attention and memory (Katsuki & Constantinidis, 2013), thereby explaining the reduction in working memory.

AUD is found to be associated with damage to the neuronal pathways underlying motivation, working memory, attention, learning and decision making (Baler & Volkow, 2006).

The intensity of damage to the working memory is found to be directly proportional to the frequency and duration of the drinking behaviour (Lechner et al., 2015). It is also found that decline in working memory and other executive functions is an effect of alcohol use and this decline in turn perpetuates the usage of alcohol (Nigg et al., 2006). Decline in working memory is found to have a direct consequence on the inability to control one's drinking behaviour as the working memory plays a major role in keeping an individual in track with the short-terms goals to be achieved (Leeman et al., 2012).

The mean score on the variable Fine Motor Skills is 262.86, showing that the sample have taken 263 seconds on an average to complete the task used for its assessment. In the present study, though the Fine Motor Skills was measured through a reduced version of the original test (dropping one pin in the holes instead of three pins as instructed in the test manual), the time taken by the sample corresponds to the 50^{th} percentile according to the norms provided by the test developer. This shows that people with AUD have a deficit in fine motor functioning.

Motor functioning involves both the motor and visual regions of the brain in addition to the areas responsible for other executive functions. Performance of a motor task requires a series of brain regions to function in coordination. Activity is initiated in the frontal lobe, followed by the cerebellum and other motor regions of the brain. The motor areas involved are the primary motor cortex, supplemental motor area, premotor cortex, precentral gyrus and the motor homunculus (Sparrow, 1983).

Alcohol not only depletes the neurons but also affects the functional connectivity density of the brain (Kojori et al., 2017) and the rate of glucose metabolism of the brain cells, especially in the visual cortex and cerebellum (Volkow et al., 2006). The damage caused due to alcohol is progressive in nature, though tolerance develops towards the substance but not towards the damage caused (Ramchandani et al., 1999). Research evidence shows the ill-effects of alcohol to include reduction in the fine motors abilities, the intensity of damage found to increase with higher doses and longer durations of consumption (Brumback et al., 2009). The same researchers have also concluded that the impairment are in some cases self-perceived but are most often true deficits of cognitive abilities.

Alcohol intoxication and the after effects of consumption affect the psychomotor abilities of individuals by not only suppressing the reflexes, but also by reducing the ability to differentiate between stimuli (Fillmore et al., 2005). The impairment in the fine motor abilities of people with AUD is also related to the difficulty in initiating and maintaining saccadic eye movements (King & Byars, 2004). The degree of impairment is relative to handedness (Schweizer et al., 2004), the complexity of the task performed (Hindmarch et al., 1991), spatial recognition (Weissenborn & Duka, 2003), confidence in performing the task (Tiplady et al., 2004) and ability to judge tasks and their consequences (Fromme et al., 1997).

The Reaction Time of the sample is observed to be below the normal level of functioning when compared to normal adults, shown by the mean of 970.06 milliseconds. Galton in the nineteenth century had observed 181 to 189 milliseconds as the range of the reaction time in young adults (Johnson et al., 1985). The present day measures of reaction time often use computerized or mobile application-based tests for assessment and hence the time taken to respond to stimuli presented varies between 233 milliseconds (Vincent et al., 2012) and 400 milliseconds (Bugg et al., 2006). Recent studies show an increase in the reaction time of individuals which is found to be an effect of increase in the screen time caused due to the response delay that the software and hardware pose, both as a habit and as a shortcoming in assessment (Dordonova & Dordonov, 2013).

Delay in reaction time can be associated to two factors, delay in detection of stimuli and the delay in response (Bielak et al., 2014). The differences in the response rate are also based on the field of vision, the right or the left. There is an increase in reaction time when stimuli are presented in the visual field contralateral to the handedness of the individual (Niemi and Naatanen, 1981). Mental Chronometry, the field of study of reaction time to stimuli, not only studies the time taken to make the physical response, but also the eye movements, vocal responses and other observable behaviours indicating the detection of a stimuli (Jensen, 2006). Studies have identified the role of the white and gray matter of the neocortical region (Kuang, 2017), and the dopamine pathways originating in the ventral tegmental area in influencing the response made to stimuli (Parker, Lamichhane, Cretano & Narayanan, 2013).

Visual reaction time is related to the left middle frontal gyrus as well as the occipital and parietal lobes of the cerebrum (Usui et al., 2009), whereas auditory reaction time is related to the

temporal lobe (Catani et al., 2003). Alcohol use causes deficits in the frontal lobe, in addition to reduced levels of information processing due to the depressing effect of alcohol (Rohrbaugh et al., 1988). Alcohol consumption, during intoxication and in instances of overuse, leads to an increase in the reaction time, showing deficient performance (Hernandez & Sprott, 2010).

Related to reaction time are perceptual speed and perceptual accuracy. Perceptual Speed and Accuracy are key cognitive abilities, supporting perceptual, cognitive and motor processes (Lezak, 2004). The white matter of the cerebrum, their structure, integrity and volume influences the perceptual speed, myelination causing increase in the speed of transmission (Posthuma et al. 2003). Perceptual Accuracy includes the selection between right and wrong responses and inhibition in responding to irrelevant stimuli in addition to the above said activities (Bender et al., 2016). These selections and controls are performed by the circuits in the frontal-subcortical regions of the forebrain and the pre-supplementary motor cortex circuits (Mostofsky & Simmonds, 2008). The present sample have deficient Perceptual Speed and Accuracy, shown by the mean scores of 31.91 and 57.90 respectively.

Due to the increase in dopamine levels during alcohol intake, regular consumption causes sensitization to higher levels of dopamine in the brain cells. When the dopamine level in the brain increases, activation of the dopaminergic pathways result in a decrease in the reaction time with reduced stimulus discrimination and response inhibition (Krull et al., 1994). This fastens the response made to stimuli, thus increasing the Perceptual Speed and decreasing the Perceptual Accuracy. The speed of processing is said to increase by three times when under the influence of alcohol, and accuracy decrease proportionally to the speed of responding and the intensity of intoxication (Bartl et al., 1996). As accuracy of response involves a higher degree of functioning compared to simple reaction time, it is found that the intensity of damage on accuracy is higher than on the reaction time task (Miles et al., 1986).

The sample were hence found to have deficits in their Cognitive Abilities, which were remediated through the use of the developed therapeutic module. The standard deviation of the sample did not show very wide variations on the variables Verbal Fluency, Categorical Fluency, Working Memory, Perceptual Speed and Perceptual Accuracy, showing that the differences between the subjects in terms of their demographic differences did not have a significant impact on the Cognitive Abilities. On the variables Attention, Fine Motor Skills and Reaction Time, the

sample have shown mild to moderate differences, hence showing extraneous factors such as abilities, normalization post refraining from alcohol use, etc., have played a role in their strength.

Hence, the hypothesis stating ‘presence of low Cognitive Abilities in people with AUD’ has been accepted.

The following tables show the effect of therapy on the Cognitive Abilities of the sample, measuring the effectiveness of Colouring, Music and Story-Telling as separate therapeutic forms and the relational effect of all the three art forms combined to be termed as HACRT. The extent of change shown by the control group is also measured to show the Cognitive Abilities of people with AUD in a 'no intervention' condition.

Table 3.1

Effect of Colouring on Cognitive Abilities of People with AUD

N=31

Cognitive Ability	**Pre-test**		**Post-test**		**Mean difference**	**t value**	**Significance**
	Mean	**SD**	**Mean**	**SD**			
Verbal Fluency	5.71	3.024	8.55	2.767	2.84	-8.031	0.000*
Categorical Fluency	8.58	2.643	12.39	3.313	3.81	-7.543	0.000*
Attention	102.81	18.934	60.26	21.827	42.55	12.956	0.000*
Working Memory	5.39	1.606	8.39	1.944	3.00	-8.645	0.000*
Fine Motor Skills	247.45	34.272	219.65	30.320	27.80	-5.641	0.000*
Reaction Time	938.90	128.764	837.90	69.066	101.00	-6.246	0.000*
Perceptual Speed	36.26	15.249	54.71	15.447	18.45	-8.199	0.000*
Perceptual Accuracy	53.10	14.689	35.94	15.312	17.16	8.319	0.000*

*Significant at 0.01 level

Figure 2.1

Effect of Colouring on Cognitive Abilities of People with AUD

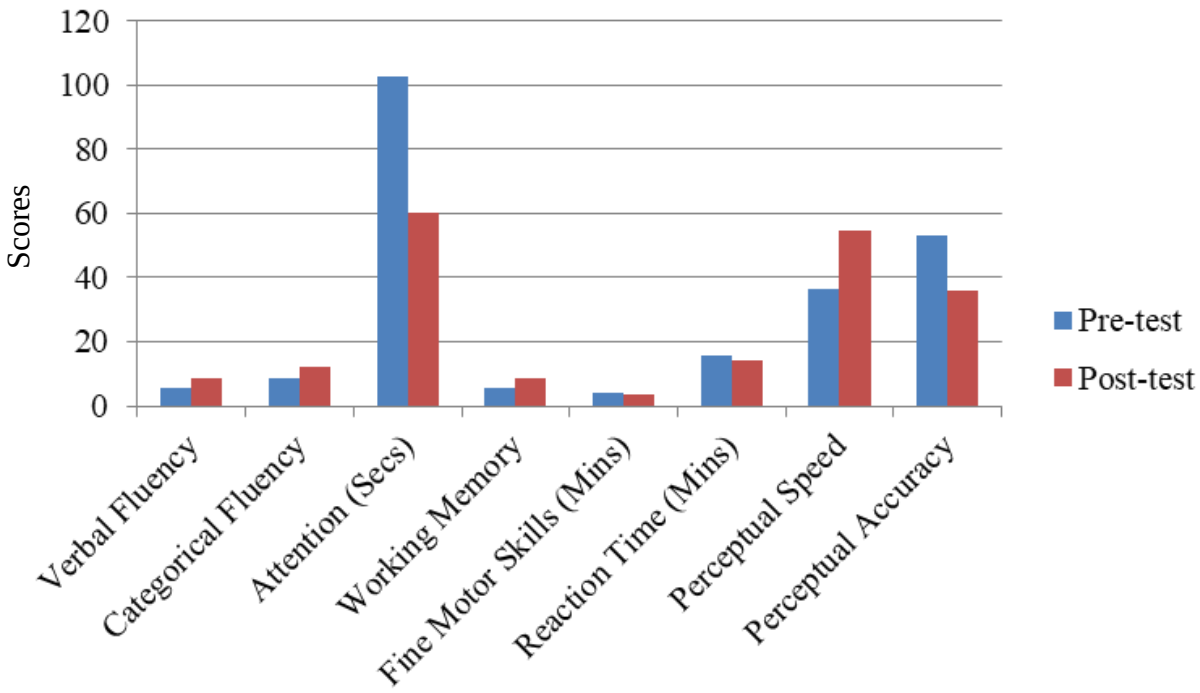

Table 3.1 and figure 2.1 show the scores on the Cognitive Abilities of the sample in the pre and post-test conditions, the difference between both stages measured in terms of the mean difference and the significance in the difference before and after intervention using Colouring as a therapeutic intervention, analysed using the paired sample t-test.

The results show that colouring has acted as an effective means of enhancing the Cognitive Abilities of people with AUD, bringing about a significant change ($p<0.01$) in terms of all the variables. The Verbal fluency of the sample has improved from ~6 words to ~8 words whereas Categorical Fluency has increased from ~9 words to ~13 words recalled per minute. In the Working Memory task, the number of threads recalled has increased from ~6 to ~9. The time taken to complete the test for Attention has reduced from 102.81 seconds to 60.21 seconds, Fine Motor Skills has reduced from 247.45 to 219.65 and Reaction Time has reduced from 938.90 milliseconds to 837.90 milliseconds. The Perceptual Speed has increased from 37 to 55 right responses, whereas the number of wrong responses has reduced from 54 to 36, showing an improvement in Perceptual Accuracy. The mean difference shows the magnitude of change

brought about by the intervention, showing on average a considerable enhancement in the Cognitive Abilities of the sample, bringing them closer to the normal individuals in terms of functioning.

When involving in a colouring activity, the frontal and occipital lobe shows activation due to the processing of visual information and the motor cortex due to the motor activity of colouring. The hippocampus, hypothalamus and limbic system are stimulated when relating to the previous encounters with the picture being coloured, emotions involved with the situation or the object in the picture and the recall of relevant colours to fill the spaces (Zaidel, 2005). Hence all these areas of the brain work in coordination to help involvement in the activity of colouring, regular practice of which increases blood flow to these areas, keeps the neuronal cells alive, strengthens the neuronal pathways and thereby enhances neuroplasticity, resulting in cognitive remediation (Draganski et al., 2004).

Colouring helps in the overall enhancement of cognitive functioning among patients with Alzheimer's disease (You et al., 2016). It is found to enhance mindfulness when practiced regularly, thereby enhancing the level of cognitive functioning (Dresler & Perera, 2019). Colours and colouring occupy a major portion of an individual's visual experiences and act as an easy and effective information channel to the cognitive system (Wichmann et al., 2002). This helps an individual to recall objects or living things based on the visual cues, which in turn help in recalling the names of them associated with their appearance (Anderson, 2017). Colours play an important role, maintaining a sustained attraction in enhancing attention and memory (Farley & Grant, 1976). Colouring is also found to reduce the reaction time and better the perceptual processes, by increasing perceptual symmetry between the two hemispheres of the brain (Chamberlain et al., 2014).

Table 3.2

Effect of Music on Cognitive Abilities of People with AUD

N=30

Cognitive Ability	Pre-test		Post-test		Mean difference	t value	Significance
	Mean	SD	Mean	SD			
Verbal Fluency	4.77	2.648	6.90	2.524	2.13	-5.690	0.000*
Categorical Fluency	6.30	2.731	9.50	3.472	3.20	-5.757	0.000*
Attention	126.70	46.162	71.20	24.532	55.50	10.052	0.000*
Working Memory	4.77	1.716	7.90	1.185	3.13	-13.414	0.000*
Fine Motor Skills	279.30	39.251	235.17	34.002	44.13	6.990	0.000*
Reaction Time	961.23	160.905	871.07	54.215	90.16	3.551	0.001*
Perceptual Speed	22.20	11.109	48.27	9.819	26.07	-15.754	0.000*
Perceptual Accuracy	67.13	11.770	42.40	9.084	24.73	14.380	0.000*

*Significant at 0.01 level

Figure 2.2

Effect of Music on Cognitive Abilities of People with AUD

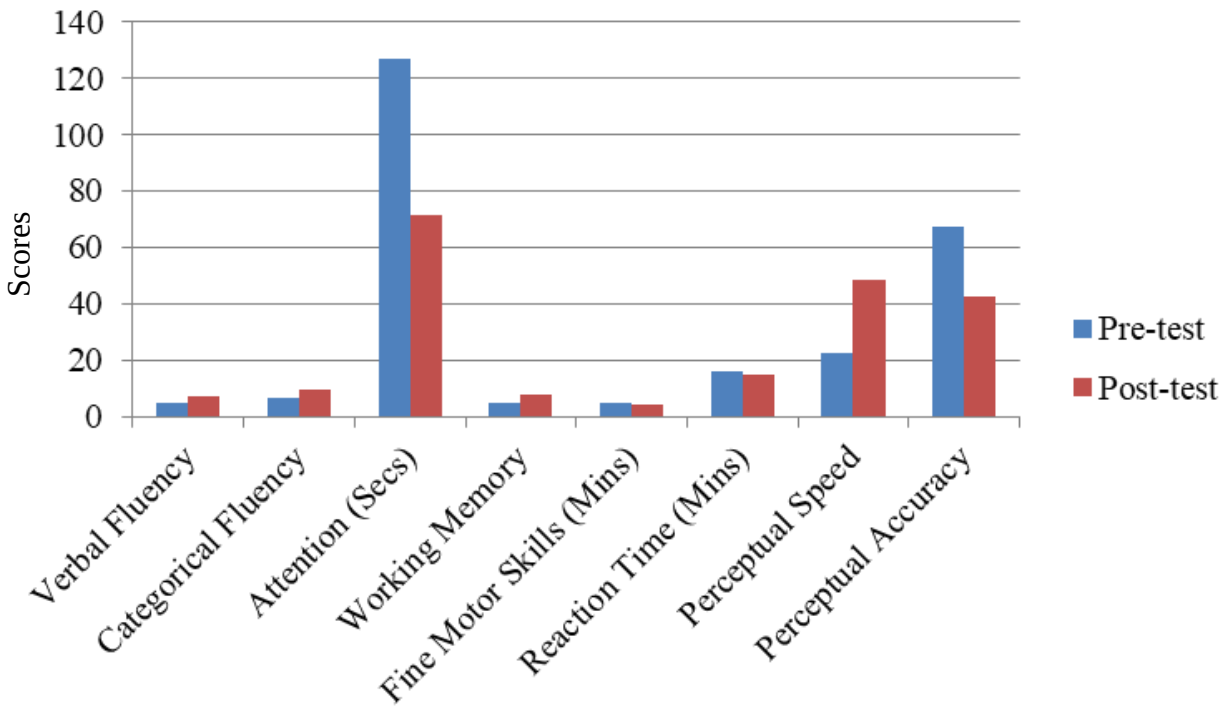

Table 3.2 and figure 2.2 show the results on the paired sample t test and the mean difference between the pre-test scores and the post-test scores after the application of Music as a therapeutic intervention. The results show that there is a significant improvement ($p<0.01$) in the Cognitive Ability of people with AUD, asserted by the mean scores. The Verbal Fluency of the sample has improved to ~7 words from ~5 words and Categorical Fluency to ~10 words from ~7 words. In the Attention task, the time taken to complete the task has reduced from 126.70 seconds to 71.20 seconds and the chunks of data recalled in the Working Memory task has increased from ~5 units to ~8 units. Completion time on the Fine Motor Task has reduced from 279.30 seconds to 235.17 seconds whereas the Reaction Time has reduced from 961.23 milliseconds to 871.07 milliseconds. The number of right responses on the Perceptual Speed task has increased from 23 digits to 49 digits, with an increase in the Perceptual Accuracy with a reduction in the number of wrong responses from 68 digits to 43 digits.

Music is found to enhance activation of the right hemisphere (Moreno et al., 2014), with respect to the prosody, pitch, timbre and rhythm of the music (Stewart et al., 2006). It is found to have an influence on the language abilities, thereby enhancing recall and fluency of words (Chan et al., 1998). Music activates the neurons and neural pathways related to the corpus callosum, thereby enhancing the communication between the brain hemispheres (Schlaug et al., 1995). It stimulates the planum temporal, the region responsible for memory related to words, thereby enhancing fluency (Keenan et al., 2001) and the inferior frontal gyrus, improving executive functions such as attention and reasoning (Gaser & Schlaug, 2003).

Exposure to music, both playing musical instruments as well as listening to music, is observed to strengthen the neurons of the cerebellum and the posterior band of the precentral gyrus, thereby influencing the motor abilities (Amunts et al., 1997). It is found to produce a positive outcome on the processing speed of individuals by the enhancement of neuroplasticity (Moussard et al., 2016), thereby decreasing the reaction time and increasing the perceptual speed (Sliwinski & Buschke, 1999). In terms of perceptual accuracy, listening to music is found to develop inhibitory control by strengthening connections in the right frontal scalp region, thereby reducing the number of errors committed (Alain et al., 2019).

Table 3.3

Effect of Story-Telling on Cognitive Abilities of People with AUD

N=31

Cognitive Ability	Pre-test		Post-test		Mean difference	t value	Significance
	Mean	SD	Mean	SD			
Verbal Fluency	6.23	2.801	7.87	2.432	1.64	-4.559	0.000*
Categorical Fluency	7.90	2.119	11.23	1.944	3.33	-8.601	0.000*
Attention	81.84	38.995	64.35	21.863	17.49	3.169	0.004*
Working Memory	6.23	1.203	7.97	1.140	1.74	-8.862	0.000*
Fine Motor Skills	255.03	43.850	239.00	37.330	16.03	2.934	0.006*
Reaction Time	985.00	113.795	918.84	77.963	66.16	3.608	0.001*
Perceptual Speed	32.48	10.865	44.16	13.849	11.68	-5.569	0.000*
Perceptual Accuracy	57.52	10.865	45.84	13.849	11.68	5.569	0.000*

*Significant at 0.01 level

Figure 2.3

Effect of Story-Telling on Cognitive Abilities of People with AUD

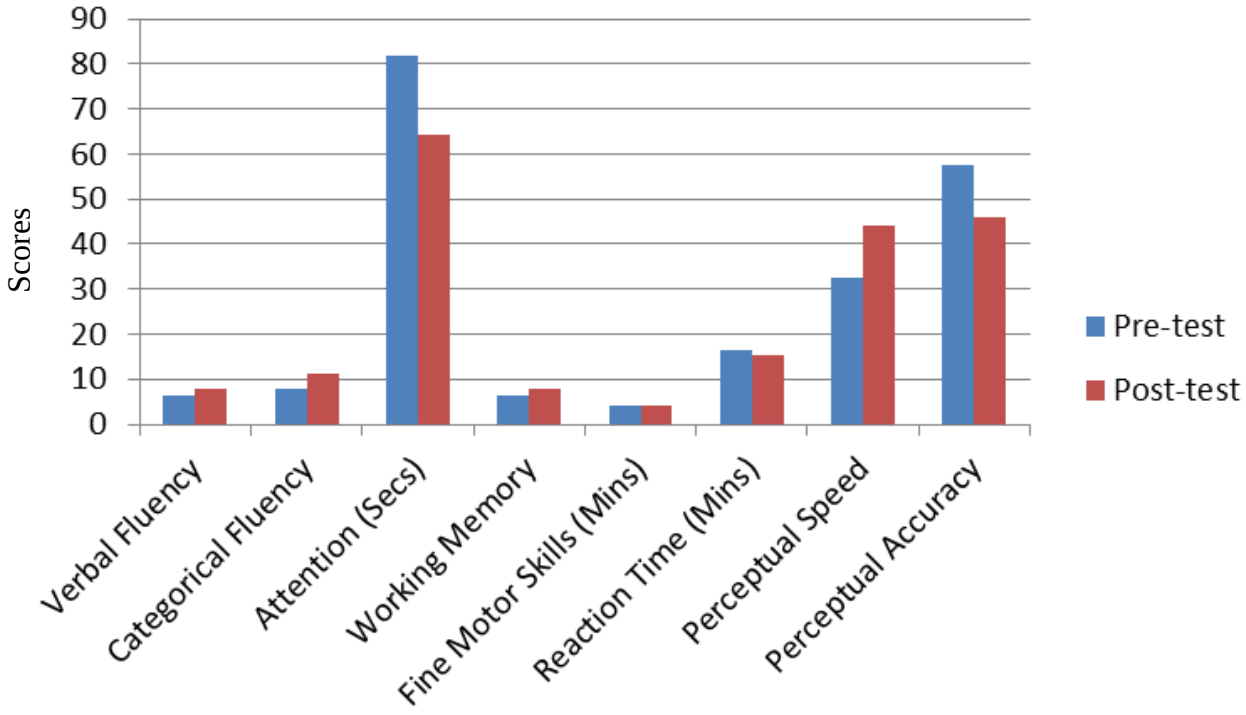

Table 3.3 and figure 2.3 show the pre and post intervention scores of the Cognitive Abilities of People with AUD, with the therapeutic intervention provided through Story-Telling. The results of the paired sample t-test and the mean difference show that there has been a significant improvement ($p<0.01$) in the Cognitive Abilities of the sample post intervention. On Verbal Fluency and Categorical Fluency, there has been an increase in recall from ~6 words to ~8 words and from ~8 words to ~11 words respectively. The time taken to complete the Trail Making Task for Attention has reduced from 81.84 seconds to 64.35 seconds and the number of trials recalled in the Working Memory task has increased from ~6 to ~8. In terms of Fine Motor Skills the duration taken to complete the task has reduced from 255.03 seconds to 239 seconds whereas on the Reaction Time task, the reduction in time taken is from 985 milliseconds to 918.84 milliseconds. The Perceptual Speed of the sample has improved to substituting 45 units in the place of 33 units with a reduction in errors to 46 units from 58 unites, showing an increase in the Perceptual Accuracy.

The effects of Story-Telling on the brain of children were studied by Yabe et al. (2018) and found that a Story-Telling activity brings about stimulation in both hemispheres in the prefrontal cortex area of the brain, with an increase in activation when practicing it on a regular basis. When a person engages in the process of Story-Telling with active imagination and an ability to reason out the turns that the storyline would take, it helps them recall and use more words, bringing about an improvement in the fluency (Gail, 1991). Another study showed that story telling can help in enhancing the overall communicative abilities of the narrator, the fluency increasing with each trial of Story-Telling (Mokhtar et al., 2010).

Stories are found to be able to synchronize neural areas associated with the story narrated which is termed 'Neural coupling', which not only benefits the narrator of the story, but also the listener. It was also observed that there is increased activation in the prefrontal cortex of the brain during processes of neural coupling, thereby enhancing the executive functions (Hasson et al., 2012). Stories that are narrated by an individual are found to produce the same kind of effect as produced by an emotion stated in the story or a motor activity of performing the narrated incident (Zak, 2015). Story narration or event narration is found to help in recall of past memories and in enhancing the retention capacity of the brain (Swain & Lapkin, 2011).

When stories are being narrated or listened to, it causes an emotional upheaval in the brain, which leads to activation of different brain areas. This arousal of the brain thereby leads to an enhancement in the brain activity (Carroll & Gibson, 2011). When presented with a visual cue (in the present study the picture), it elicits activation in the visual cortex, which through further processes elicits the other areas of the brain respectively, based on the emotion involved, the memory associated to the visuals, actions taken to handle the situation, the words chosen to narrate the story, etc. (Pakkan et al., 2018).

Table 3.4

Effect of HACRT on Cognitive Abilities of People with AUD

N=32

Cognitive Ability	Pre-test		Post-test		Mean difference	t value	Significance
	Mean	SD	Mean	SD			
Verbal Fluency	6.66	2.881	10.41	2.077	3.75	-14.117	0.000*
Categorical Fluency	7.94	2.422	11.91	1.279	3.97	-10.681	0.000*
Attention	68.56	30.516	50.31	10.914	18.25	3.751	0.001*
Working Memory	6.97	1.513	10.34	1.285	3.37	-12.938	0.000*
Fine Motor Skills	253.19	46.874	221.22	34.787	31.97	7.015	0.000*
Reaction Time	972.09	120.226	917.13	64.483	54.96	3.944	0.000*
Perceptual Speed	35.47	14.660	51.06	10.473	15.59	-8.616	0.000*
Perceptual Accuracy	54.84	14.993	38.94	10.473	16.20	8.499	0.000*

*Significant at 0.01 level

Figure 2.4

Effect of HACRT on Cognitive Abilities of People with AUD

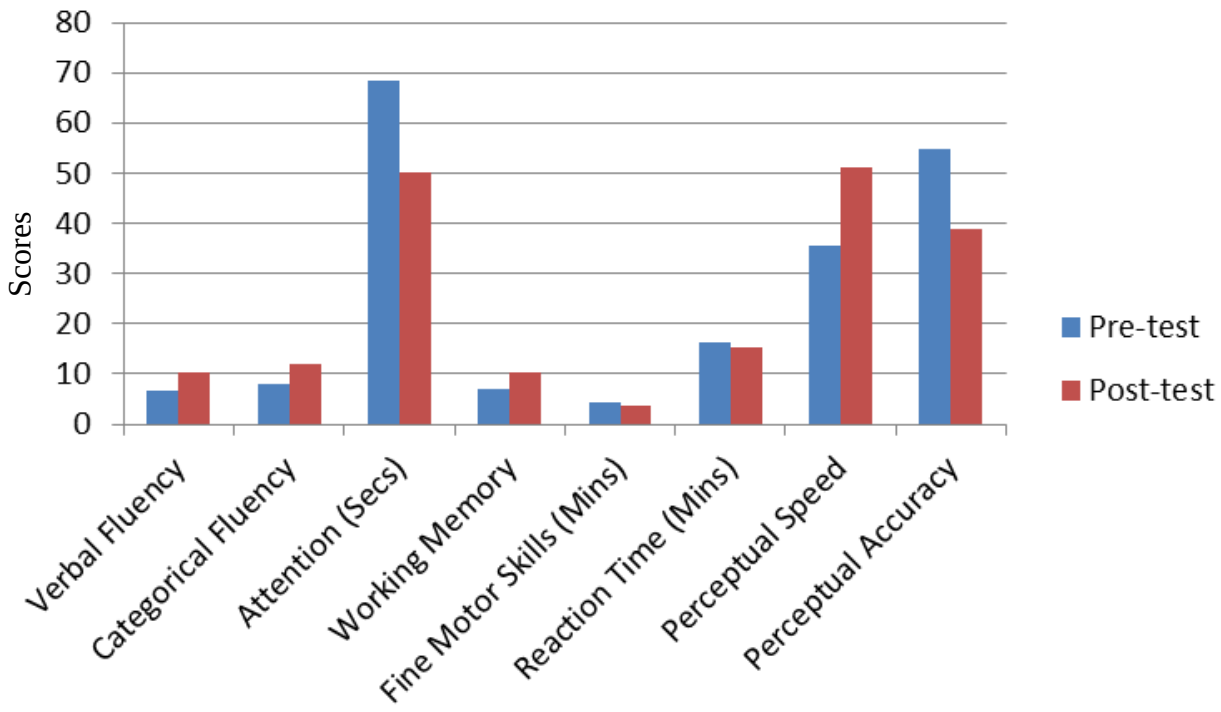

Table 3.4 and figure 2.4 show the Cognitive Abilities of people with AUD at pre intervention and post intervention, following therapeutic application using all three art forms, namely, Colouring, Music and Story-Telling. The paired sample t- test shows significant improvement ($p<0.01$) in the Cognitive Abilities of the sample as an effect of the intervention provided. The mean difference shows the intensity of change produced by the application of the intervention module. The enhancement in ability to recall improved from ~7 words to ~11 words in the case of Verbal Fluency and from ~8 words to ~12 words in the case of Categorical Fluency. On Attention, the time taken to complete the task reduced to 50.31 seconds from 68.56 seconds whereas Working Memory showed betterment from the ability to recall ~11 units in the place of ~7 units. The Fine Motor Skills Task recorded a reduction in time taken from 253.19 seconds to 221.22 and the Reaction Time task was completed in 917.13 milliseconds in contrast to 972.09 milliseconds consumed before intervention. On the DLST, Perceptual Speed increased from 36 to 52 right responses and Perceptual Accuracy reduced from 55 to 39 wrong responses.

Colouring, Music and Story-Telling have been individually effective in bringing about Cognitive Remediation, evident through the data discussed in the previous tables and further substantiated by findings of past literature. When an individual is subjected to all three art forms, it produces a cumulative effect, thereby proving effective in bringing about the desired change. Though the individual effect of the different art forms has been researched upon, a combination of different art forms applied in unison is not much explored.

Table 3.5

Cognitive Abilities of People with AUD under Control Condition

N=31

Cognitive Ability	Pre-test		Post-test		Mean difference	t value	Significance
	Mean	SD	Mean	SD			
Verbal Fluency	6.23	2.432	6.35	1.889	0.12	-0.436	0.666^{ns}
Categorical Fluency	7.48	2.031	6.87	2.061	-0.61	1.500	0.144^{ns}
Attention	88.97	30.765	87.10	33.155	1.87	0.969	0.340^{ns}
Working Memory	6.00	2.033	6.68	1.777	0.68	-3.407	0.002*
Fine Motor Skills	280.16	48.827	277.55	48.866	-3.01	0.724	0.474^{ns}
Reaction Time	992.74	119.653	975.68	112.253	17.06	2.953	0.006*
Perceptual Speed	32.71	13.377	35.71	8.459	3.00	-2.161	0.039**
Perceptual Accuracy	57.29	13.377	54.29	8.459	3.00	2.161	0.039**

*Significant at 0.01 level **Significant at 0.05 level ^{ns}Not Significant

Figure 2.5

Cognitive Abilities of People with AUD under Control Condition

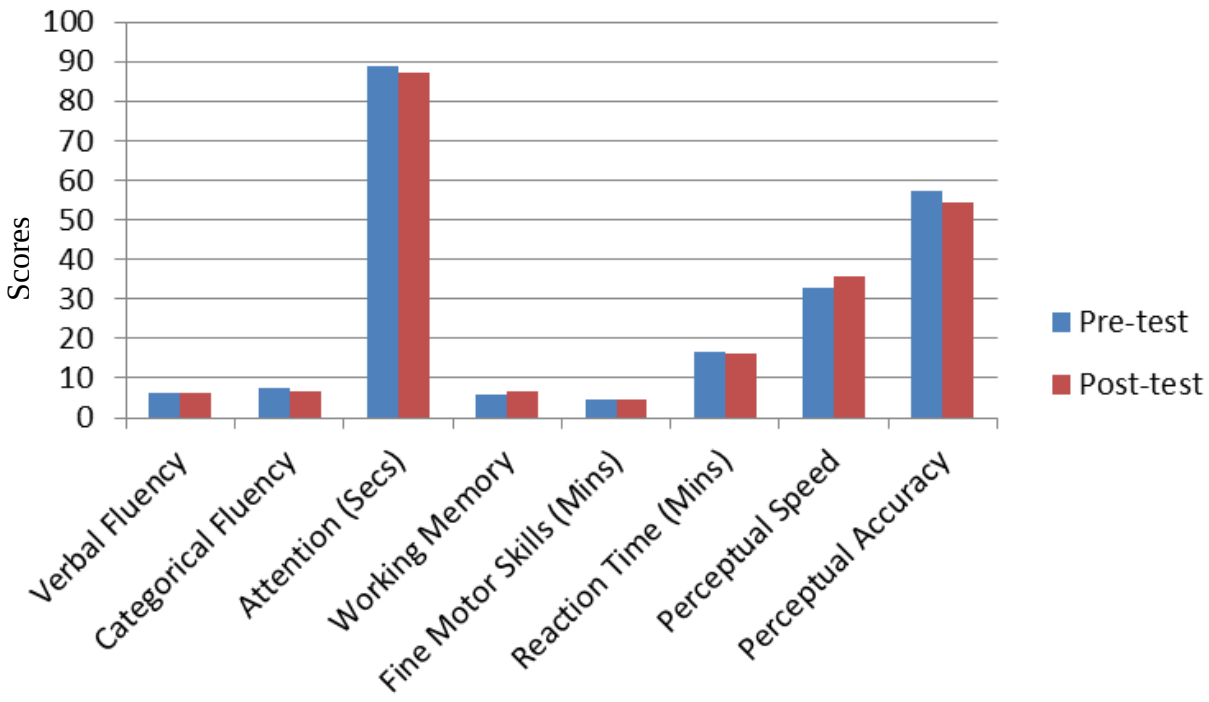

Table 3.5 and figure 2.5 show the Cognitive Abilities of people with AUD in a no intervention condition. Verbal Fluency has been retained in the ability to recall ~6 words after the forty-eight day period as shown by the mean values, whereas Categorical Fluency has shown a decline from ~8 words to ~7 words. On Attention, the time taken to complete the task has shown a slight improvement from 88.97 seconds to 87.10 seconds and on Working Memory, ability to recall has increased from ~6 chunks to ~7 chunks. In terms of Fine Motor Skills, the time taken has shown a negligible improvement from 280.16 seconds to 277.55 seconds, whereas on Reaction Time, time taken to respond to stimuli has improved from 992.74 seconds to 975.68 seconds. In the test for Perceptual Speed, number of right substitutions has increased by three units from 33 to 36 and Perceptual Accuracy has decreased from 57 wrong responses to 54 wrong responses.

The pre and post-test comparison performed using the paired sample t-test shows significant differences on few variables whereas a few are insignificant. The mean difference

shows the difference in the mean scores before and after the forty-eight days period, with negative scores on Categorical Fluency and Fine Motor Skills, showing decline in Cognitive functioning after cessation of alcohol consumption as well. The scores on Verbal Fluency, Categorical Fluency, Attention and Fine Motor Skills do not show a significant improvement ($p>0.5$) whereas Perceptual Speed and Perceptual Accuracy show significance at the 0.05 level, with Working Memory and Reaction Time showing 0.01 level of significance in enhancement.

Studies exploring the natural remediation of Cognitive Abilities post detoxification show mixed results. Some studies stated that there was no improvement in the post detoxification phase naturally (Fujiwara et al., 2008; Loeber et al., 2010), whereas others reported that the cognitive abilities get restored during abstinence (Durazzo et al., 2007; Rosenbloom et al., 2004). The differences in recovery is found to be based on the individual's baseline physiological and cognitive abilities (Berlucchi, 2011), demographic factors (Schottenbauer et al., 2007), duration of drinking and the period of abstinence from alcohol.

Reversal of the biological changes post detoxification plays a major role in the natural remediation process (Kiefer et al., 2001; Leclercq et al., 2012). The volume of grey matter in the brain is found to increase after two weeks of abstinence, hence abilities fostered by grey matter functioning reaching an enhanced state of performance (Eijk et al., 2013). Individuals in the state of abstinence have an enhanced emotional state without anxiety or craving for the substance, making them feel confident, which helps in maintaining a balanced state of performance at the cognitive level (Dolan, 2002). Differences in the extent of remediation between cognitive abilities can be due to the underlying neural mechanism involved in the performance of that particular activity of cognition.

Hence, the hypothesis stating that 'the developed therapeutic module will be effective in bringing about Cognitive Remediation in people with AUD' has been accepted.

The following tables show the inter-group comparison of the effectiveness of the different therapeutic art forms in bringing about change in each of the variables explored. The groups received Colouring, Music and Story-Telling as the intervention. All three therapeutic forms were administered to the fourth group, namely, Colouring, Music and Story-Telling in order to understand the relational effect of the three art forms. The last group was considered the wait-list control group, and therapy was provided to this group after the conduction of the post-test assessments.

Table 4.1

Effect of Intervention on the Verbal Fluency of People with AUD

N=155

Verbal Fluency	Sum of Squares	df	Mean Square	F value	Post hoc
Between subject	315.091	4	78.773		HACRT > Colouring > Story-Telling > Music > Control group
Within subject	832.677	150	5.551	14.190*	
Total	1147.768	154			

*Significant at 0.01 level

Figure 3.1

Effect of Intervention on the Verbal Fluency of People with AUD

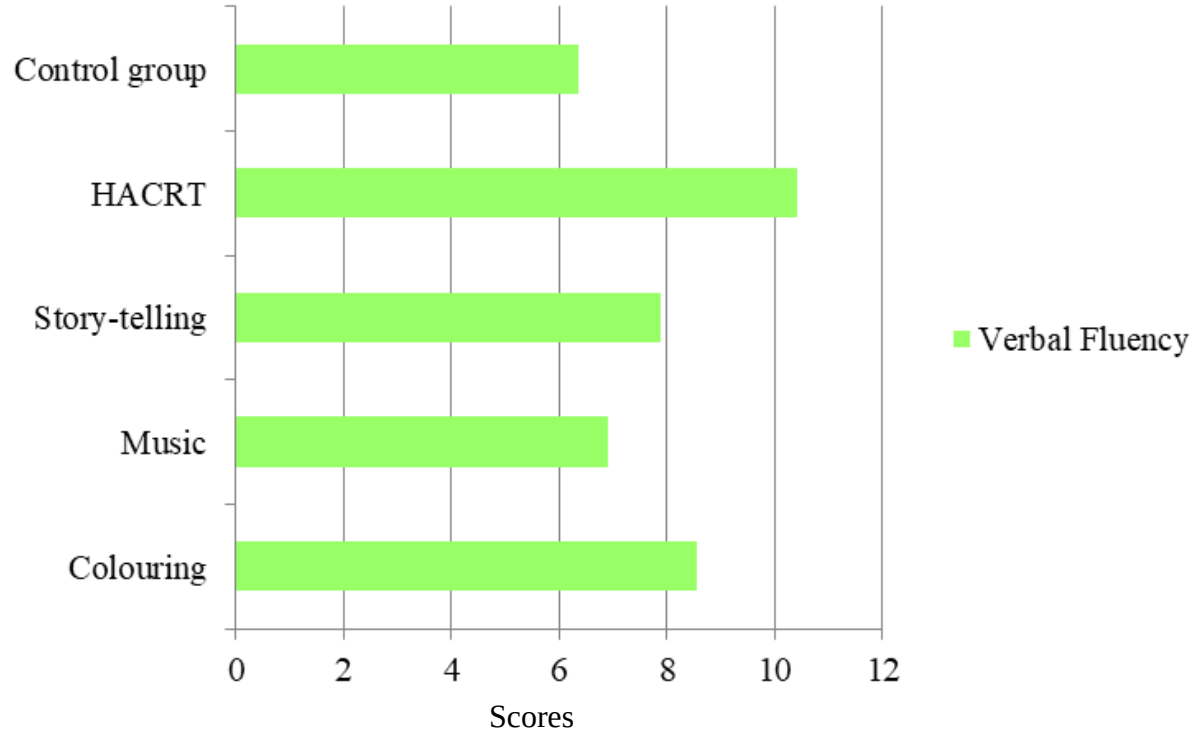

Table 4.1 and figure 3.1 show the inter-comparison between the effects of the different art forms applied as intervention on the Verbal Fluency of people with AUD. The results of the One-way ANOVA ($F(4, 150)=14.190$) show that there are significant differences ($p<0.01$) in the degree of change brought about by the different art forms and HACRT in bringing about Cognitive Remediation in people with AUD in addition to the differences in the post-test scores of the control group.

Based on the presence of significance on the one-way ANOVA, a Duncan Post hoc analysis was carried out to identify the condition that had brought about the maximum degree of improvement. The results show that HACRT ($\mu=10.41$) has shown a greater degree of benefit when compared to the individual art forms. Of the individual art forms, Colouring ($\mu=8.55$) had been the most effective, followed by Story-Telling ($\mu=7.87$) and Music ($\mu=6.90$) whereas the control group ($\mu=6.35$) showed a poor improvement.

The control group had shown very marginal improvement in the post-test condition, thereby showing that refraining from alcohol use does not reverse the damage caused in terms of the Verbal Fluency in people with AUD. Though past literature show contradictory evidence (Manning et al., 2008), the present study shows minimal or no improvement on Verbal Fluency post detoxification without the administration of required intervention. The duration of alcohol overuse has been found to play a major role in determining ability in terms of Verbal Fluency (Fortier et al., 2008).

Table 4.2

Effect of Intervention on the Categorical Fluency of People with AUD

N=155

Categorical Fluency	Sum of Squares	Df	Mean Square	F value	Post hoc
Between subject	626.517	4	156.629	24.209*	Colouring > HACRT > Story-Telling > Music > Control group
Within subject	970.477	150	6.470		
Total	1596.994	154			

*Significant at 0.01 level

Figure 3.2

Effect of Intervention on the Categorical Fluency of People with AUD

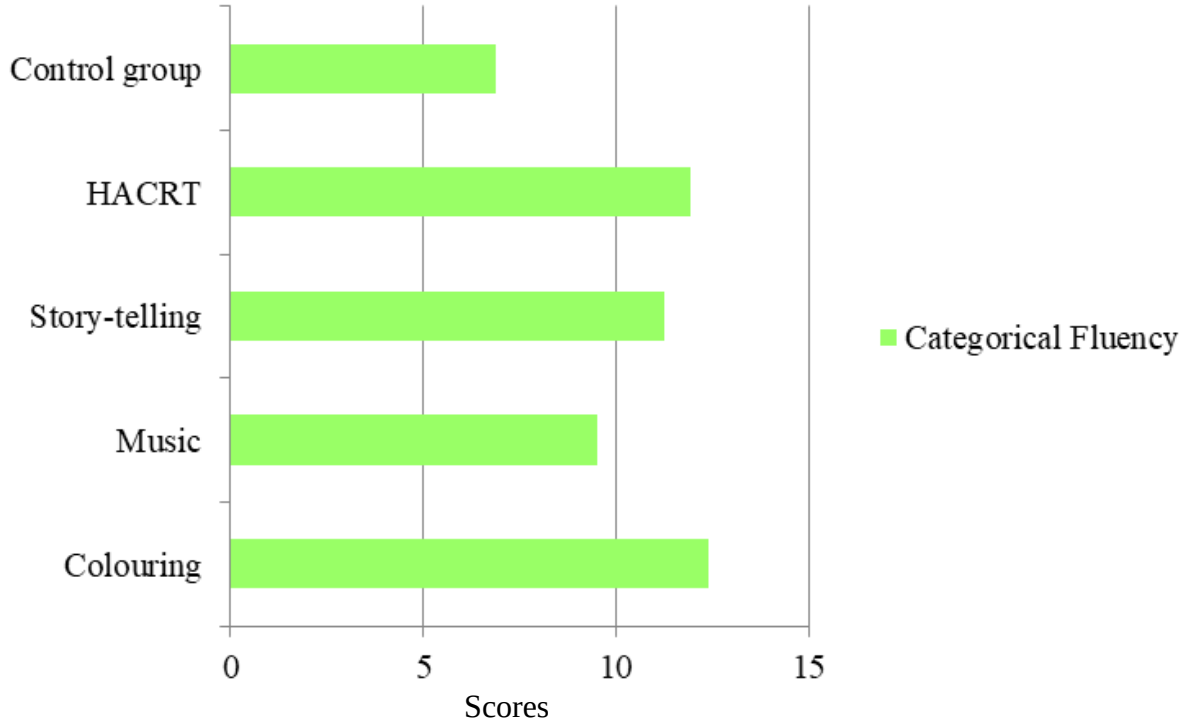

Table 4.2 and figure 3.2 show the effect of the different treatment conditions on the variable Categorical Fluency. The results of the one-way ANOVA ($F(4, 150)=24.209$) show that the individual art forms, holistic and the waitlist-control treatment conditions have been significantly different ($p<0.01$) in improving the Categorical Fluency of people with AUD, showing that different functions result in different changes in the brain and functionality.

Further analysis using the Duncan Post hoc shows the intensity of improvement caused by the treatment where Colouring ($\mu=12.39$) has been the most helpful, followed by HACRT ($\mu=11.91$), Story-Telling ($\mu=11.23$) and Music ($\mu=9.50$). In case of the control group, the ability of Categorical Fluency ($\mu=6.87$) is comparatively low, showing decline in ability without intervention. Deficiency in Categorical Fluency of subjects were found to be persistent even after detoxification (Fortier et al., 2008), which can be accounted to cortical atrophy in regions responsible for response acquisition (McGlinchey et al., 2002).

Table 4.3

Effect of Intervention on the Attention of People with AUD

N=155

Attention	Sum of Squares	df	Mean Square	F value	Post hoc
Between subject	23549.319	4	5887.330		HACRT > Colouring > Story-Telling > Music > Control group
Within subject	82753.417	150	551.689	10.671*	
Total	106302.735	154			

*Significant at 0.01 level

Figure 3.3

Effect of Intervention on the Attention of People with AUD

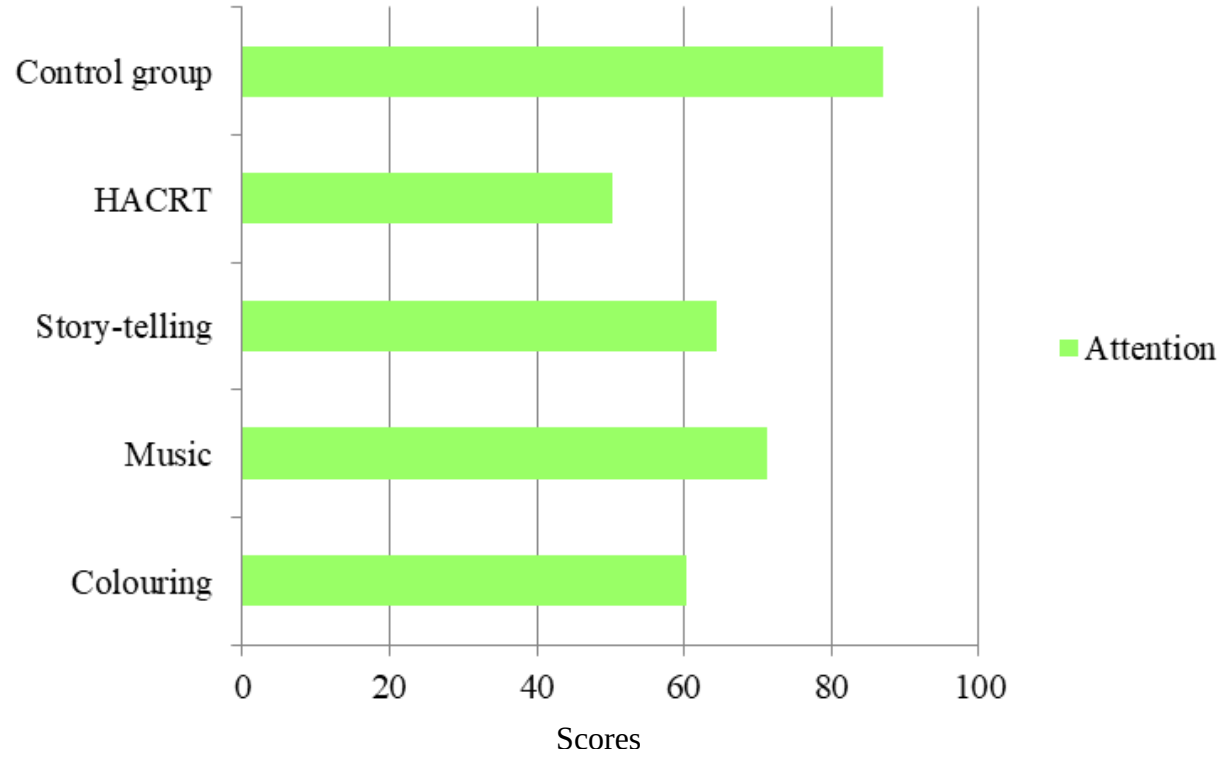

Table 4.3 and figure 3.3 show the Scores on Attention shows the between subject and within subject comparison between the effect of the five different conditions at the post-test level. Analysis performed by the one-way ANOVA ($F(4, 150)=10.671$) shows presence of a significant difference ($p<0.01$) in the time taken to complete the task as an effect of the intervention, showing differences in the effectiveness of each therapeutic trial.

The results of the Duncan Post hoc show that HACRT ($\mu=50.31$) has been most effective in enhancing Attention, followed by Colouring ($\mu=60.26$), Story-Telling ($\mu=64.36$), Music (71.20) and the control condition ($\mu=87.10$). Therefore it is evident that the combination of different art forms targeting different brain regions has been most effective in reducing the time taken to complete the task measuring Attention. Exploration of the reversal of attention deficits in the second week after detoxification showed persistence of the deficits (Uva et al., 2010), but a regain in the ability at a very slow rate when abstaining from alcohol, hence iterating the need for intervention.

Table 4.4

Effect of Intervention on the Working Memory of People with AUD

N=155

Working Memory	**Sum of Squares**	**df**	**Mean Square**	**F value**	**Post hoc**
Between subject	223.604	4	55.901		HACRT > Colouring > Story-Telling > Music > Control group
Within subject	339.016	150	2.260	24.734*	
Total	562.619	154			

*Significant at 0.01 level

Figure 3.4

Effect of Intervention on the Working Memory of People with AUD

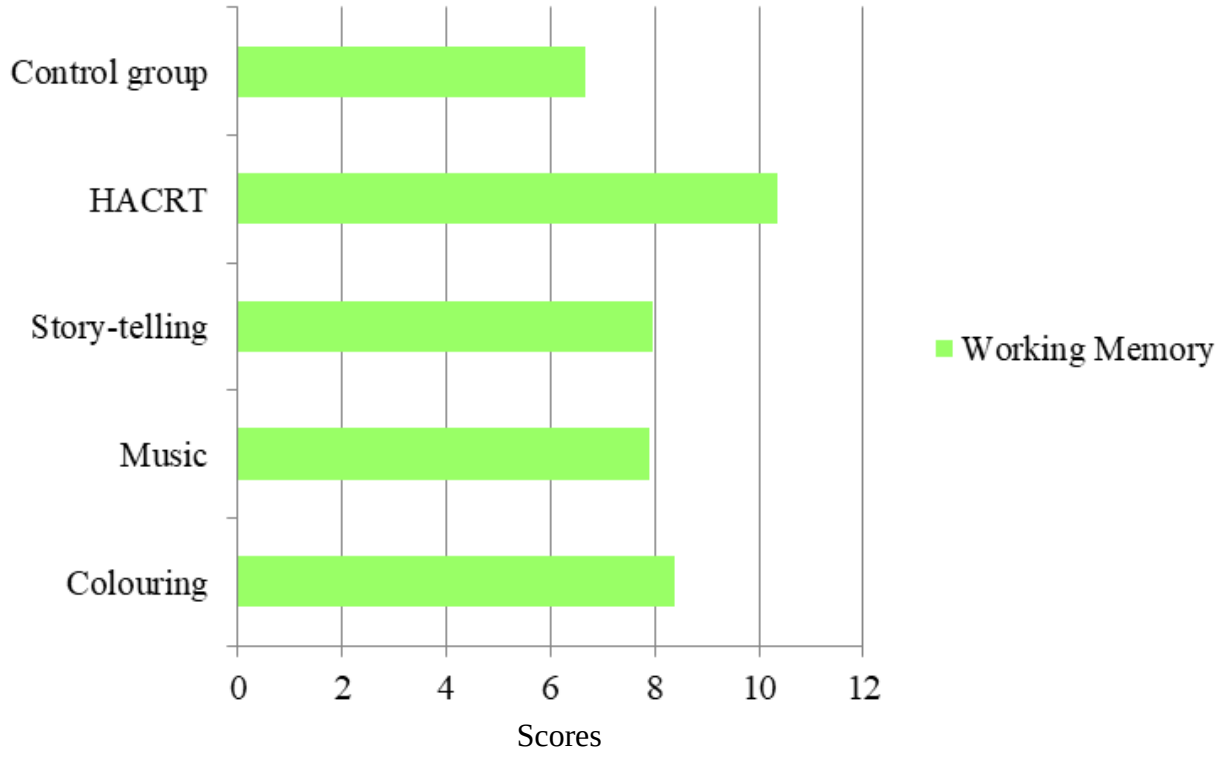

Table 4.4 and figure 3.4 show the comparative effect of the five different treatment conditions on the Working Memory scores of people with AUD in the post test condition, showing the differences in the effectiveness of the different therapeutic forms in improving Working Memory. The F value obtained as a result of the one-way ANOVA ($F(1,150)=24.734$) shows presence of a significant difference ($p<0.01$) in the level of enhancement of Working Memory of the sample under all five conditions.

As a further extension to explore the differences between the treatment conditions, Duncan Post hoc was applied to present the intensity of change brought about by the different art forms, a relative effect of them and that of the control group. The results show that HACRT ($\mu=10.34$) had been most effective in enhancing the Working Memory, followed by Colouring ($\mu=8.39$), Story-Telling ($\mu=7.97$) and Music ($\mu=7.90$). The least performance was exhibited in the control condition ($\mu=6.68$), showing the necessity for intervention in bringing about a higher magnitude of improvement. Previous studies show mixed evidence on the reversal of Working

Memory during sobriety, where slight enhancement was seen in the initial days of abstinence (Rosenbloom et al., 2004), but there was no regain of the baseline abilities even when staying in recovery for longer time periods (Sullivan et al., 2005). This disturbance in the Working Memory of people with AUD can be associated to imbalance in the neurotransmitter acetylcholine (DeRosa & Sullivan, 2003).

Table 4.5

Effect of Intervention on the Fine Motor Skills of People with AUD

N=155

Fine Motor Skills	Sum of Squares	df	Mean Square	F value	Post hoc
Between subject	68185.487	4	17046.372		Colouring > HACRT > Music > Story-Telling > Control group
Within subject	212062.410	150	1413.749	12.058*	
Total	280247.897	154			

*Significant at 0.01 level

Figure 3.5

Effect of Intervention on the Fine Motor Skills of People with AUD

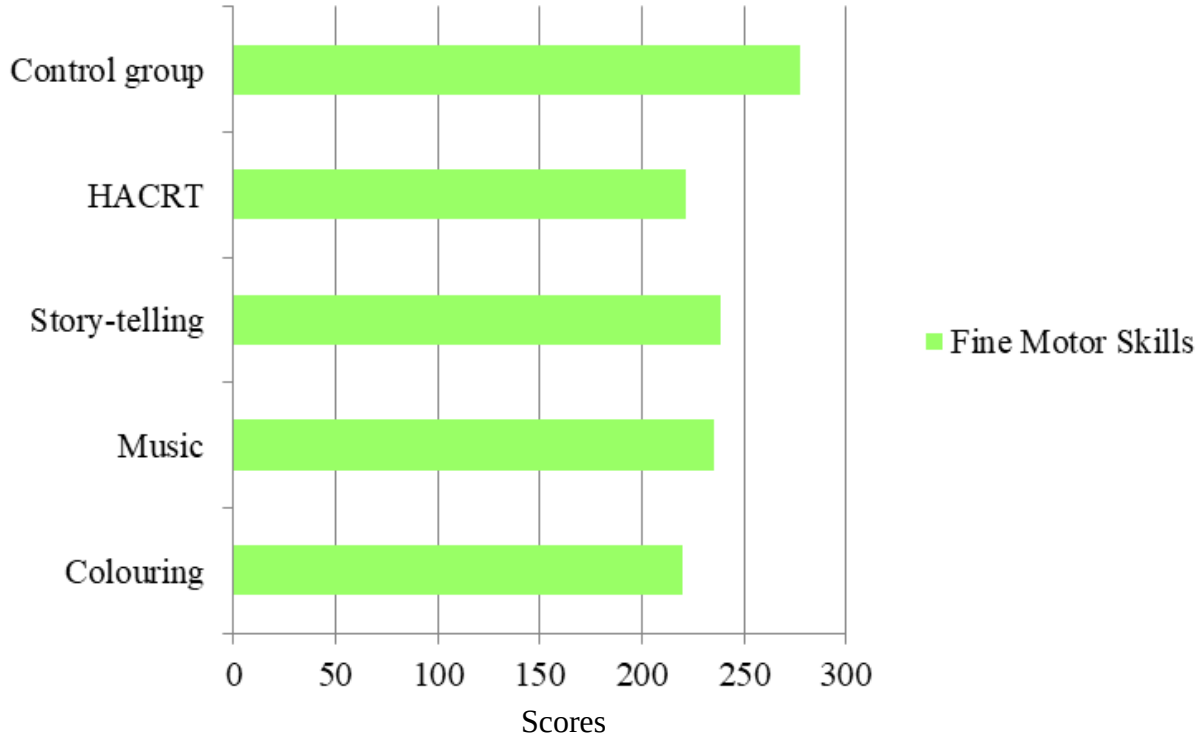

Table 4.5 and figure 3.5 show the scores on the Fine Motor Skills of people with AUD, at the post treatment condition, tabulated to show the between subject and within subject comparison values respectively. The F score ($F(4, 150)=12.058$) shows that the groups subjected to the different therapeutic interventions show a significant difference ($p<0.01$), among them.

Furthering the analysis using a Duncan Post hoc helps in ordering the different treatment conditions according to the extent of improvement produced by them. It can be observed that Colouring ($\mu=219.55$) has the highest effectiveness followed by HACRT ($\mu=221.22$), Music ($\mu=235.17$), Story-Telling ($\mu=239.00$) and with no intervention ($\mu=277.55$). This shows that the stimulation produced by the fine motor activity of Colouring has been most beneficial in remediating the Fine Motor Skill abilities of people with AUD, by helping the reduction of time taken in completing the assigned task. Previous research has shown evidence for the persistence of fine motor and visuo-spatial ability deficits in people with AUD even during long periods of

abstinence, due to the neuronal damage caused by alcohol (Fein, Torres, Price & Di Sclafani, 2006), thereby showing need for intervention.

Table 4.6

Effect of Intervention on the Reaction Time of People with AUD

N=155

Reaction Time	Sum of Squares	df	Mean Square	F value	Post hoc
Between subject	339548.698	4	84887.174		Colouring > Music > HACRT > Story-Telling > Control group
Within subject	917615.044	150	6117.434	13.876*	
Total	1257163.742	154			

*Significant at 0.01 level

Figure 3.6

Effect of Intervention on the Reaction Time of People with AUD

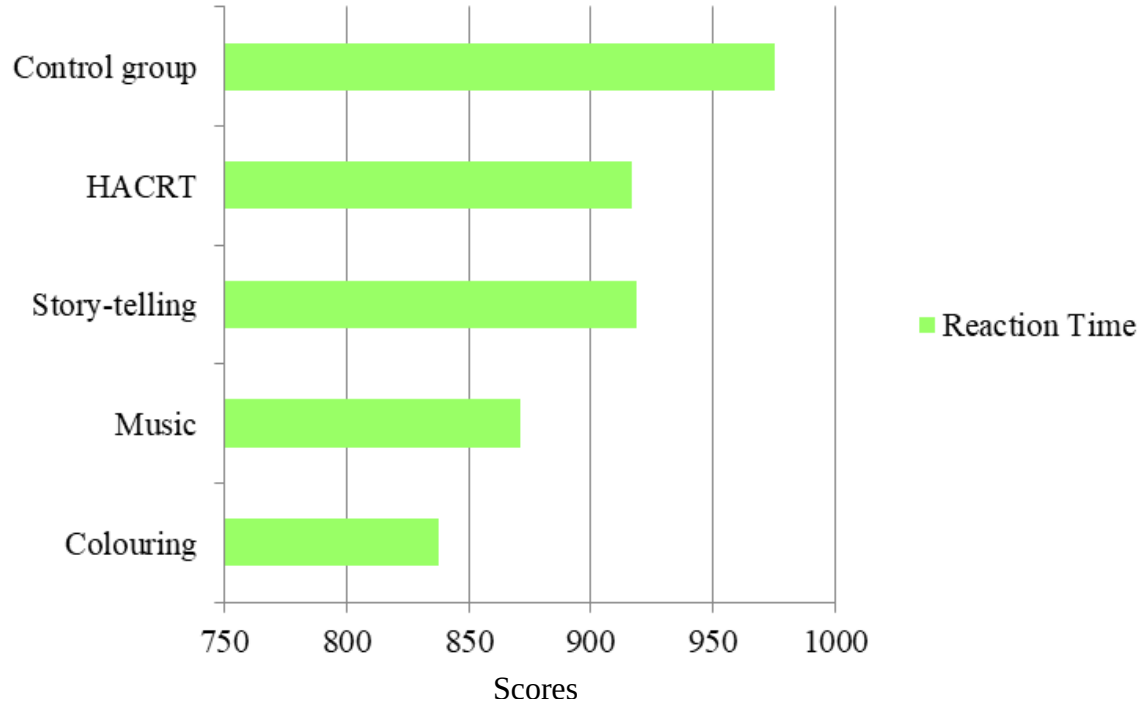

Table 4.6 and figure 3.6 show the comparison of the different treatment conditions in bringing about change on the Reaction Time of people with AUD on the intensity of improvement produced. The one-way ANOVA ($F(4,150)=13.876$) was used in comparing the post levels of Reaction Time in each study group, exploring the differences in the effectiveness of the individual therapeutic art forms, the relational effect and the no intervention condition. The F values indicate a significant difference ($p<0.01$) between the groups, with different levels of improvement in each treatment condition, thereby showing the variation between the different strategies.

Post hoc analysis by the Duncan method shows that Colouring ($\mu=837.90$) had been the most effective art form in reducing the time taken to react to a stimulus, followed by Music ($\mu=871.07$), HACRT ($\mu=917.13$) and Story-Telling ($\mu=918.84$). As a behavioural response to a stimulus requires motor ability in addition to cognitive functioning, Colouring employed as a motor activity, had been effective in bettering the Reaction Time. In the 'no treatment' condition ($\mu=975.88$), though there was an enhancement in the Reaction Time compared to the pre-test condition, the intensity of change was lesser as compared to the other groups which received treatment. Myelination of neurons responsible for the faster transmission of signals in the nervous system, increase the grey matter in the brain during abstinence from alcohol leading to respond better even in the absence of a psychological treatment being provided (Petit et al., 2017).

Table 4.7

Effect of Intervention on the Perceptual Speed of People with AUD

N=155

Perceptual Speed	Sum of Squares	df	Mean Square	F value	Post hoc
Between subject	6614.091	4	1653.523		Colouring > HACRT > Music > Story-Telling > Control group
Within subject	21254.709	150	141.698	11.669*	
Total	27868.800	154			

*Significant at 0.01 level

Figure 3.7

Effect of Intervention on the Perceptual Speed of People with AUD

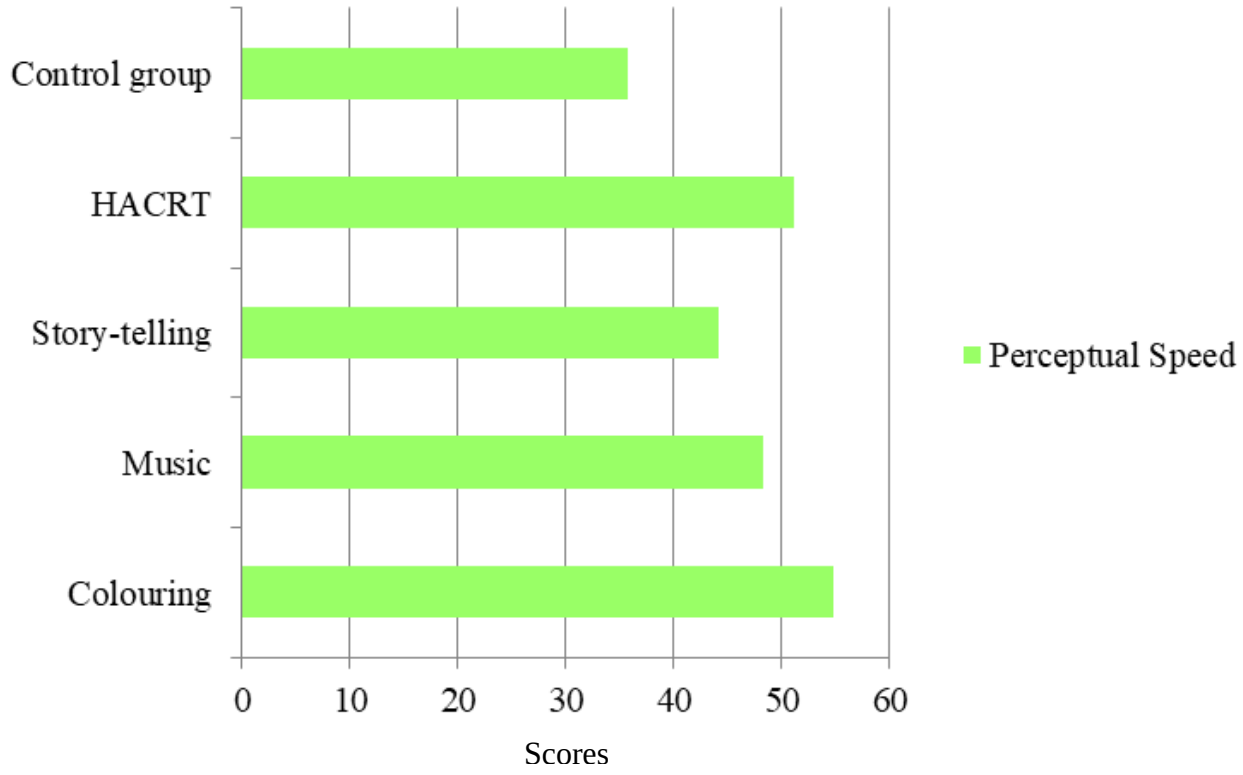

Table 4.7 and figure 3.7 show the results of the comparison of the Perceptual Speed of people with AUD, at the post test condition, to show the differences between the therapeutic conditions analysed using the one-way ANOVA. The groups which received therapy by means of the three different art forms, HACRT as well as the control group, showed a significant difference ($p<0.01$) in the Perceptual Speed ($F(4,150)=11.669$) of the sample.

Further analysis using the Duncan Post hoc was conducted in exploring the intensity of change produced. Based on the results of the analysis it was evident that Colouring ($\mu=54.71$) had been highly influential in bringing about a betterment in the Perceptual Speed of the sample, followed by HACRT ($\mu=51.06$), Music ($\mu=48.27$), Story-Telling ($\mu=44.16$) and the control group ($\mu=35.71$) showing the least number of right responses. Colouring having the ability to stimulate the brain through practice, has led to increased exercise of the visual and motor areas of the brain, which has reflected upon the perceptual speed of the sample.

Table 4.8

Effect of Intervention on the Perceptual Accuracy of People with AUD

N=155

Perceptual Accuracy	Sum of Squares	df	Mean Square	F value	Post hoc
Between subject	6254.951	4	1563.738		Colouring > HACRT > Music > Story-Telling > Control group
Within subject	20727.527	150	138.184	11.316*	
Total	26982.477	154			

*Significant at 0.01 level

Figure 3.8

Effect of Intervention on the Perceptual Accuracy of People with AUD

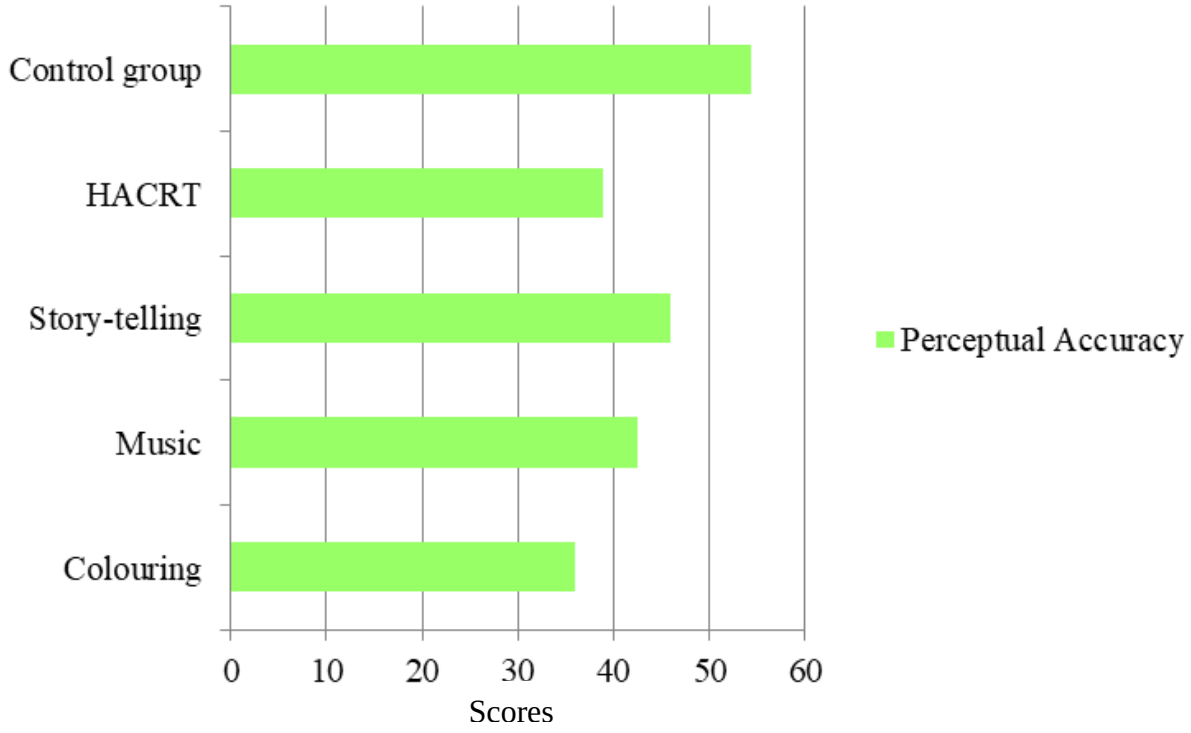

Table 4.8 and figure 3.8 show the results of the between group and within group comparison between the different therapeutic forms in enhancing the Perceptual Accuracy in people with AUD, post intervention using different treatment conditions so as to show the effectiveness of each condition. The results of the one-way ANOVA ($F(4,150)=11.316$) show the differences to be significant ($p<0.01$) between the different groups that received therapeutic intervention and the group with no intervention.

The results of the Duncan Post hoc show that Colouring ($\mu=35.94$) has been the most effective treatment strategy in enhancing the Perceptual Accuracy of people with AUD, followed by HACRT ($\mu=38.94$), Music ($\mu=42.40$) and Story-Telling ($\mu=45.84$). Following intervention, the groups have shown a reduction in the number of wrong responses, thereby indicating that there is an enhancement in the Perceptual Accuracy of the sample. In the control group ($\mu=54.29$), though there is a change in the desired direction compared to the pre-test condition, the intensity of change is very low, showing need for therapeutic intervention to remediate the

ability to produce lesser number of errors. Thus inability to regain accuracy can be accounted to reduce inhibitory control in people exposed to alcohol, even when in abstinence (Berger & Orr, 1983).

Hence, the hypothesis stating that ‘HACRT will be more effective than the individual art forms in bringing about change’ has been partially accepted, as different variables have shown different intensities of improvement under each condition.

The following tables show the Neuro-Behavioural Functioning of people with AUD. The mean, median and standard deviation values of the sample at the pre-test condition show the level of Neuro-Behavioural Functioning of the sample as an effect of the abuse of alcohol. The Neuro-Behavioural Functioning of the sample is measured in terms of six dimensions of functioning, namely, Depression, Somatic, Memory, Communication, Aggression and Motor.

Table 5

Neuro-Behavioural Functioning of People with AUD before Intervention

N=155

Dimension	Mean	SD	Test value	Mean difference	t value	Significance
Depression	38.46	7.128	25.16	13.30	23.227	0.000*
Somatic	30.85	6.389	18.46	12.39	24.148	0.000*
Memory	45.41	8.218	36.16	9.25	14.018	0.000*
Communication	22.65	6.580	17.95	4.70	8.884	0.000*
Aggression	23.26	6.782	13.70	9.56	17.557	0.000*
Motor	18.01	4.351	15.67	2.34	6.703	0.000*

*Significant at 0.01 level

Figure 4

Neuro-Behavioural Functioning of People with AUD before Intervention

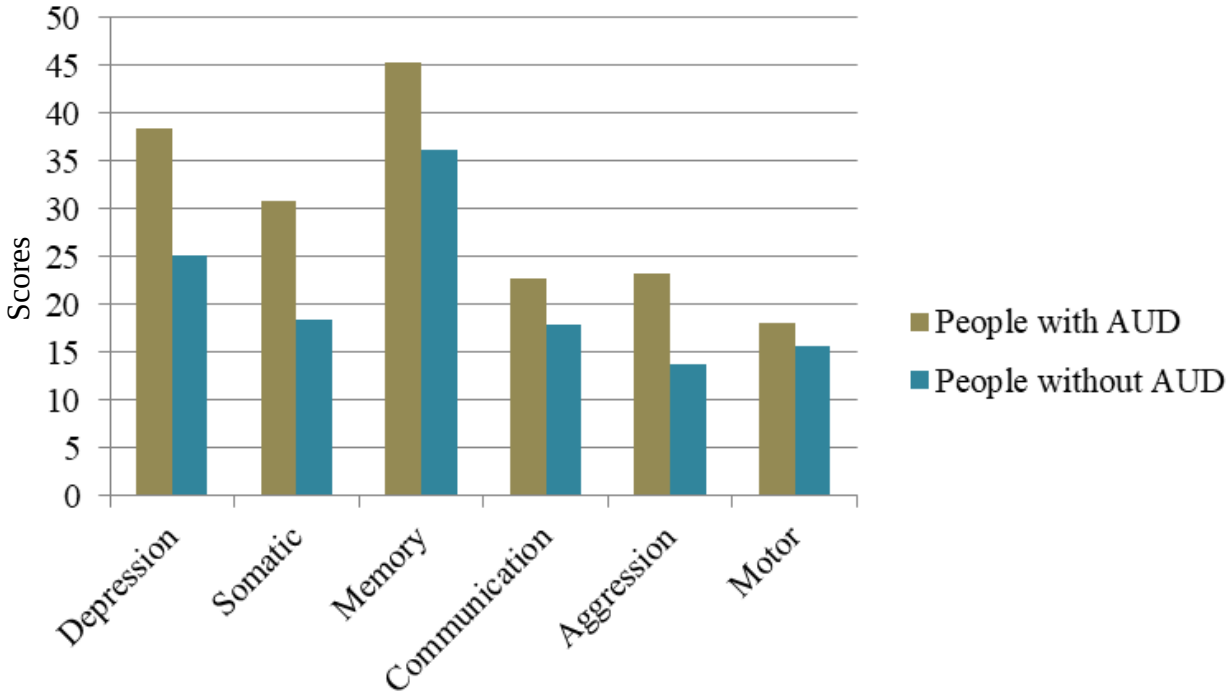

Table 5 and figure 4 show the Neuro-Behavioural Functioning of people with AUD in terms of the Mean and Standard Deviation. The significance in the difference between the mean scores of people with AUD and the normal population (Kreutzer et al., 1999) is analysed using one-sample t-test and the mean difference shows the strength of deficit. The mean difference is obtained by subtracting the test value (Neuro-Behavioural Functioning score of the normal population as provided by the author of the Neuro-Behavioural Functioning Inventory) from the mean score of the sample.

On depression, people with AUD have scored a mean of 38.46 falling under the 58th percentile according to the norms provided by the author. On Somatic dimension, the mean value of 30.85 corresponds to the 46th percentile and the mean of 45.41 on Memory falls under the 58th percentile. In case of Communication, Aggression and Motor, the mean scores of 22.65, 23.26 and 18.01 fall under the percentiles of 38, 38 and 34 respectively. This shows that the level of

Neuro-Behavioural Functioning of the sample is interpreted as being ‘Average’ based on the norms provided by the author (Kreutzer et al., 1999).

The t values show that the Neuro-Behavioural Functioning of people with AUD is significantly different ($p<0.01$) from that of the normal population. The mean difference shows the extent of difference in the Neuro-Behavioural Functioning between the two groups. A mean difference of 13.30 on Depression, 12.39 on Somatic, 9.25 on Memory, 4.70 on Communication, 9.56 on Aggression and 2.34 on Motor dimensions has been observed in people with AUD. An increase in the scores shows a decrease in the level of Neuro-Behavioural Functioning where higher mean differences indicate a reduced functioning level in the test group.

Previous studies show that neurobehavioural deficits are not evident in all individuals diagnosed with AUD, whereas some of them develop permanent brain damage needing custodial care (Oscar-Berman & Evert, 1997). It is also observed that most people develop mild damage that improves eventually during abstinence (Crews et al., 2005). It is necessary to concentrate on the neuro-psychological and neuro-behavioural damages of alcohol abuse, as it not only impairs functioning, but also increases risk of relapse (Petrakis et al., 2002). These damages can be attributed to changes in the frontal lobe, limbic system and cerebellum particularly, in addition to other areas (Oscar-Berman & Marinkovic, 2014).

Hence, the hypothesis stating ‘presence of a low level of Neuro-Behavioural Functioning in people with AUD’ has been accepted.

The following tables show the comparison of the Neuro-Behavioural Functioning of people with AUD in the pre-test and post-test conditions, showing the effectiveness of the therapeutic art forms provided to the sample.

Table 6.1

Effect of Colouring on Neuro-Behavioural Functioning of People with AUD

N=31

Neuro-Behavioural Functioning	Pre-test		Post-test		Mean difference	t value	Significance
	Mean	SD	Mean	SD			
Depression	37.84	8.079	28.16	4.726	9.68	6.177	0.000*
Somatic	32.94	7.206	16.35	3.158	16.59	11.025	0.000*
Memory	49.06	7.019	28.94	9.619	20.12	10.321	0.000*
Communication	25.10	5.770	12.03	4.363	13.07	9.869	0.000*
Aggression	21.32	5.689	9.97	2.008	11.35	10.162	0.000*
Motor	19.94	3.803	10.16	1.293	9.78	13.670	0.000*

*Significant at 0.01 level

Figure 5.1

Effect of Colouring on Neuro-Behavioural Functioning of People with AUD

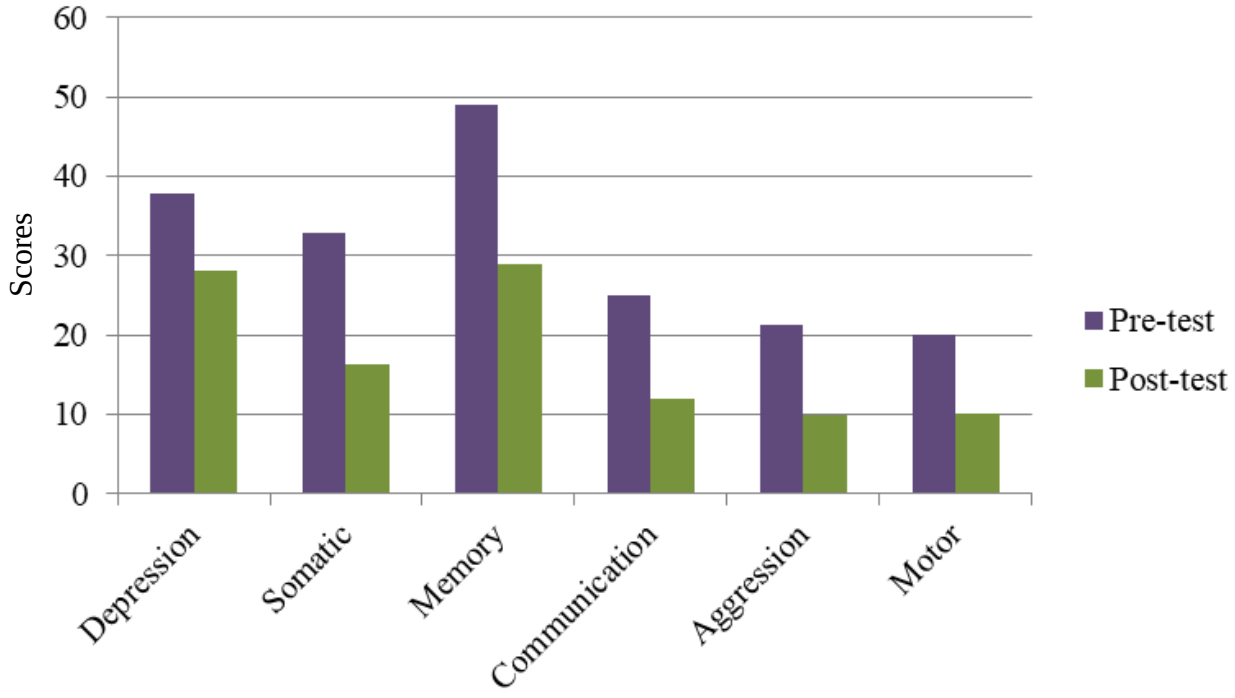

Table 6.1and figure 5.1 show the Neuro-Behavioural Functioning of people with AUD in the pre and post-test conditions. Results of the paired sample t-test show the effectiveness of Colouring as a therapeutic art form in enhancing the functioning of the sample. The t values show that there is a significant enhancement ($p<0.01$) on all dimensions of Neuro-Behavioural Functioning post application of the therapy. The scores on the dimensions Depression, Somatic and Memory have reduced from 37.84 to 28.16, 32.94 to 16.35 and 49.06 to 28.94 respectively. On the dimension Communication the betterment is shown by a decrease in the mean from 25.10 to 12.03. In terms of Aggression, the score has decreased from 21.32 to 9.97 and on the Motor dimension there is a decrease from 19.94 to 10.16.

The decrease in the scores indicates an enhancement in the Neuro-Behavioural Functioning of people with AUD, post application of the therapeutic intervention. Colouring is found to be effective in the reduction of depression (Zhang et al., 2005) and other stress related bodily symptoms (Lewis et al., 2006), in addition to healing emotional imbalances (Camic, 2008). Past literature shows evidence for enhancement of productivity through practice of

colouring even in cases of brain damage (Boller et al., 2005) and neurodegenerative damage (Fornazzari, 2005). There is a repair in the brain cells brought about by engaging in art forms, which is reflected on their overt behaviour. The mean difference indicates the extent of enhancement in the Neuro-Behavioural Functioning of people with AUD.

Table 6.2

Effect of Music on Neuro-Behavioural Functioning of People with AUD

N=30

Neuro-Behavioural Functioning	Pre-test		Post-test		Mean difference	t value	Significance
	Mean	SD	Mean	SD			
Depression	39.17	7.922	28.73	4.479	10.44	6.322	0.000*
Somatic	31.67	8.027	16.33	2.857	15.34	9.129	0.000*
Memory	50.13	10.477	28.93	9.344	21.20	8.720	0.000*
Communication	26.43	8.106	11.47	2.240	14.96	9.889	0.000*
Aggression	20.13	7.546	10.27	2.363	9.86	6.591	0.000*
Motor	21.13	5.124	10.37	1.650	10.76	11.601	0.000*

*Significant at 0.01 level

Figure 5.2

Effect of Music on Neuro-Behavioural Functioning of People with AUD

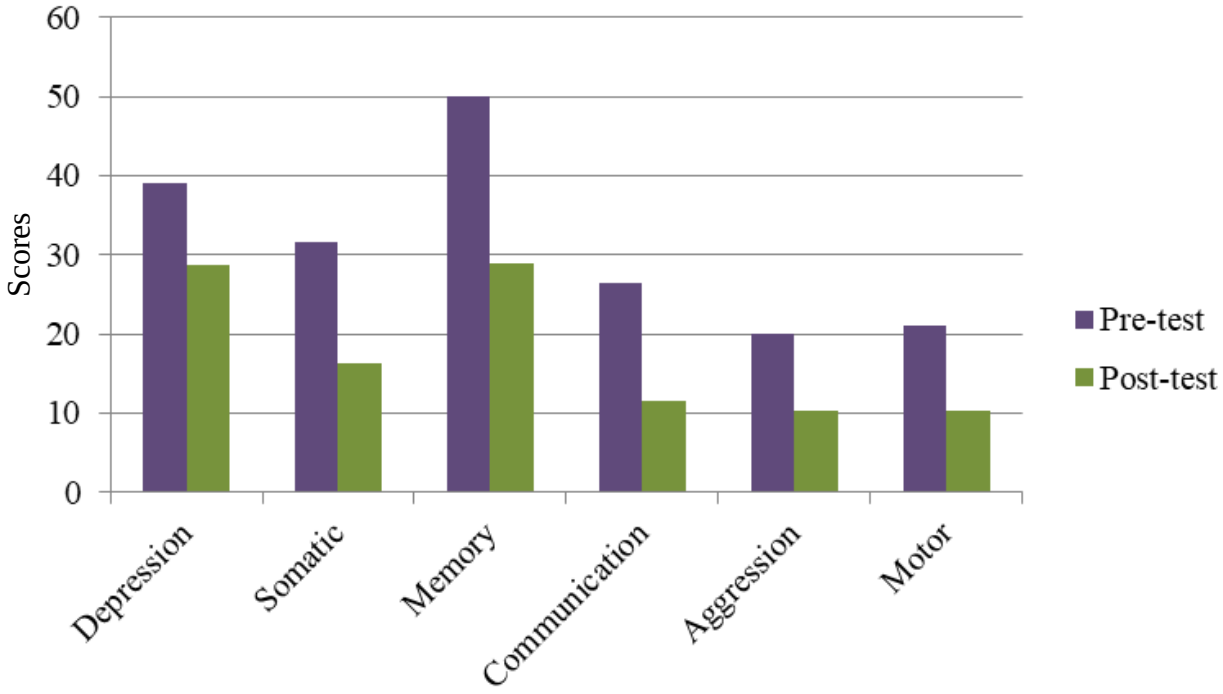

Table 6.2 and figure 5.2 show the Neuro-Behavioural Functioning of people with AUD in the pre and post-test conditions under the effect of Music as a therapeutic intervention. The results of the paired sample t-test show the pre and post-test comparison of scores, the value showing significant improvement ($p<0.01$) in all dimensions of Neuro-Behavioural Functioning of people with AUD. The mean difference shows the intensity of enhancement on the functioning of the sample as an effect of the intervention provided.

On the dimension Depression, there is a decrease in the mean value from 39.17 to 28.73. On the dimensions of Somatic, Memory and Communication, there is a decrease in the mean scores from 31.67 to 16.33, 50.13 to 28.93 and 26.43 to 11.47 respectively. In terms of Aggression enhancement is shown by a decrease in score from 20.13 to 10.27 and on Motor from 21.13 to 10.37. Music is found to stimulate brain functioning in areas of perception, memory, emotion and performance, thereby showing the role of music in enhancing Neuro-Behavioural Functioning (Peretz & Zatorre, 2005). Music is found to be an effective therapy for neuronal memory enhancement and in fighting neurodegenerative disorders (Patel, 2007).

Music is found to an uplifter of emotions, bringing about enhancement in the mood state in cases of depression and other mood disorders (Maratos et al., 2008). The role of music in accessing and stimulating specific cerebral circuits leads to the benefits brought about by it as a therapy (Trimble & Hesdorffer, 2017). Music is found to be effective in reducing aggressive behaviours (Greitemeyer, 2011) and in modulating cognitive, affective and behavioural functioning (Sharman & Dingle, 2015).

Table 6.3

Effect of Story-Telling on Neuro-Behavioural Functioning of People with AUD

N=31

Neuro-Behavioural Ability	Pre-test		Post-test		Mean difference	t value	Significance
	Mean	SD	Mean	SD			
Depression	38.84	6.094	28.81	4.053	10.03	7.913	0.000*
Somatic	30.29	5.330	15.58	3.775	14.71	11.334	0.000*
Memory	42.94	5.366	30.74	9.448	12.20	6.969	0.000*
Communication	19.45	5.982	12.10	3.487	7.35	5.507	0.000*
Aggression	24.48	5.853	10.94	2.645	13.54	11.889	0.000*
Motor	15.97	3.060	10.71	1.953	5.26	10.309	0.000*

*Significance at 0.01 level

Figure 5.3

Effect of Story-Telling on Neuro-Behavioural Functioning of People with AUD

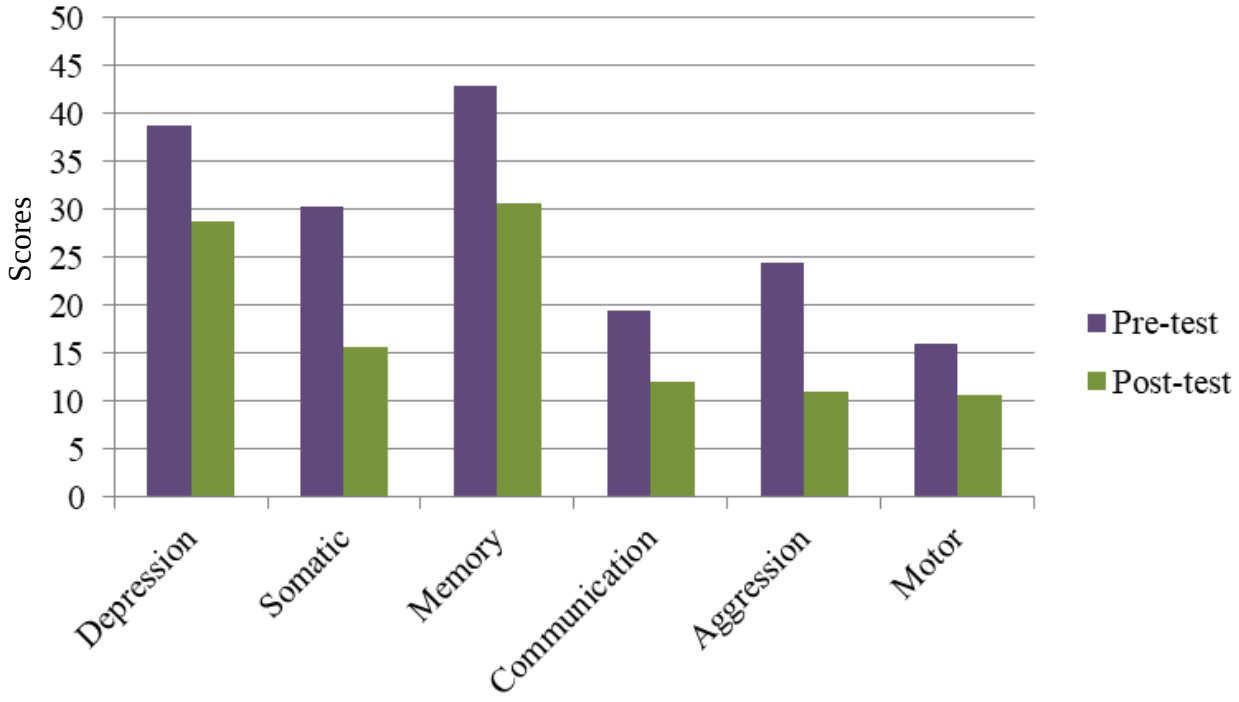

Table 6.3 and figure 5.3 show the pre and post test scores on the Neuro-Behavioural Functioning of people with AUD, showing the effect of Story-Telling as a therapeutic art form. The results of the paired sample t-test shows a significant enhancement ($p<0.01$) in the Neuro-Behavioural Functioning of the sample. The difference in the mean values between the pre and post intervention conditions shows the intensity of change brought about by Story-Telling.

The mean value of the dimension Depression has decreased from 38.84 to 28.81, Somatic dimension has decreased from 30.29 to 15.58 and Memory dimension has reduced from 42.94 to 30.74. On the dimensions Communication and Aggression the decrease in mean values are observed to be from 19.45 to 12.10 and 24.48 to 10.94 respectively and on Motor functioning the decrease is from 15.97 to 10.71. The decrease in the mean values from the pre-test to the post-test conditions show that there is an improvement in the Neuro-Behavioural Functioning of people with AUD.

Research evidence states that narrating stories has an extensive benefit in the management of depression and in positively influencing the mood state of people. It helps in venting out of emotions and in overcoming traumatic memories (Stibich, 2019). Stories help to visualize the events being narrated, hence stimulating the brain by the vivid imaginations. It enhances communication abilities by bringing about clarity of thought and expression (Kataoka & Sakurai, 1998). The advantages of Story-Telling also extend to health benefits such as releasing stress and reducing pain, dealing with the somatic symptoms of distress (Pennebaker, 2000).

Table 6.4

Effect of HACRT on Neuro-Behavioural Functioning of People with AUD

N=32

Neuro-Behavioural Ability	Pre-test		Post-test		Mean difference	t value	Significance
	Mean	SD	Mean	SD			
Depression	37.75	8.179	28.63	5.204	9.12	5.251	0.000*
Somatic	29.78	6.328	16.13	3.220	13.65	9.808	0.000*
Memory	41.72	6.976	29.78	10.232	11.94	5.562	0.000*
Communication	19.59	5.079	11.31	2.147	8.28	7.928	0.000*
Aggression	25.38	6.680	10.59	2.650	14.79	10.727	0.000*
Motor	16.81	3.702	10.25	1.524	6.56	8.689	0.000*

*Significance at 0.01 level

Figure 5.4

Effect of HACRT on Neuro-Behavioural Functioning of People with AUD

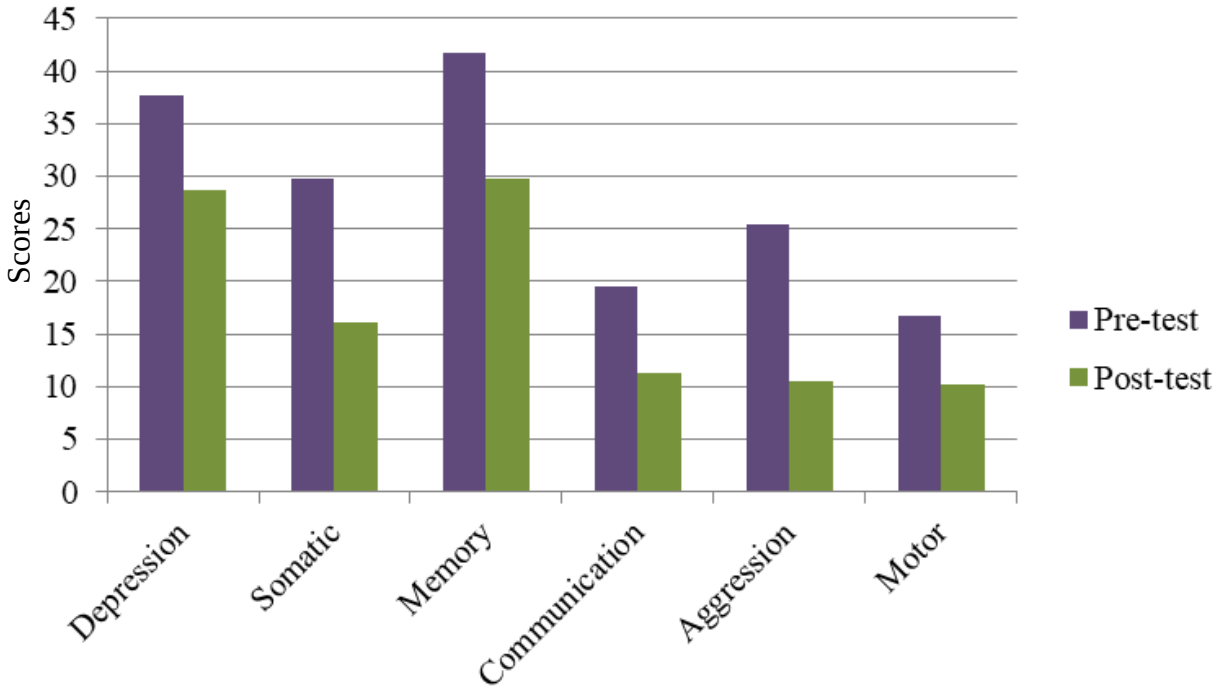

Table 6.4 and figure 5.4 show the Neuro-Behavioural Functioning of people with AUD in the pre and post conditions, tabulating the mean, standard deviation and t value scores to show the effectiveness of HACRT in enhancing the Neuro-Behavioural Functioning of the sample. The results of the paired sample t-test show that the applied therapeutic intervention has brought about a significant betterment in the Neuro-Behavioural Functioning of people with AUD.

The Mean scores indicate the differences in the functioning before and after intervention and the mean difference shows the extent of improvement attained. In terms of Depression, enhancement is shown by a decrease in the mean value from 37.75 to 28.63. On the Somatic dimension there is a decrease from 29.78 to 16.13 and on the Memory dimension there is a decrease from 41.72 to 29.78. The dimensions Communication, Aggression and Memory show a reduction from 19.59 to 11.31, from 25.38 to 10.59 and from 16.81 to 10.25 respectively. The

decrease in the mean values shows that there is an enhancement in the Neuro-Behavioural Functioning of people with AUD as an effect of HACRT.

Different art forms have been experimented upon to prove its effectiveness as therapy. Role of art forms in managing psychosomatic disorders (Holmqvist & Persson, 2012), emotional difficulties and pain (Wood et al., 2011), stress (Huet, 2015), trauma (Schouten et al., 2015), psychiatric disorders such as depression (Uttley et al., 2015) has been established through previous researches.

Table 6.5

Neuro-Behavioural Functioning of People with AUD under Control Condition

N=31

Neuro-Behavioural Ability	Pre-test		Post-test		Mean difference	t value	Significance
	Mean	SD	Mean	SD			
Depression	38.74	5.190	36.94	5.686	1.8	1.230	0.228^{ns}
Somatic	29.65	4.160	19.48	3.567	10.17	9.472	0.000*
Memory	43.48	7.169	49.06	1.777	-5.58	-3.064	0.005*
Communication	22.87	4.681	23.84	4.934	-0.97	-0.798	0.431^{ns}
Aggression	24.84	6.768	14.61	4.402	10.23	7.938	0.000 *
Motor	16.35	3.401	15.65	2.665	0.70	0.835	0.411^{ns}

*Significant at 0.01 level ^{ns}Not significant

Figure 5.5

Neuro-Behavioural Functioning of People with AUD under Control Condition

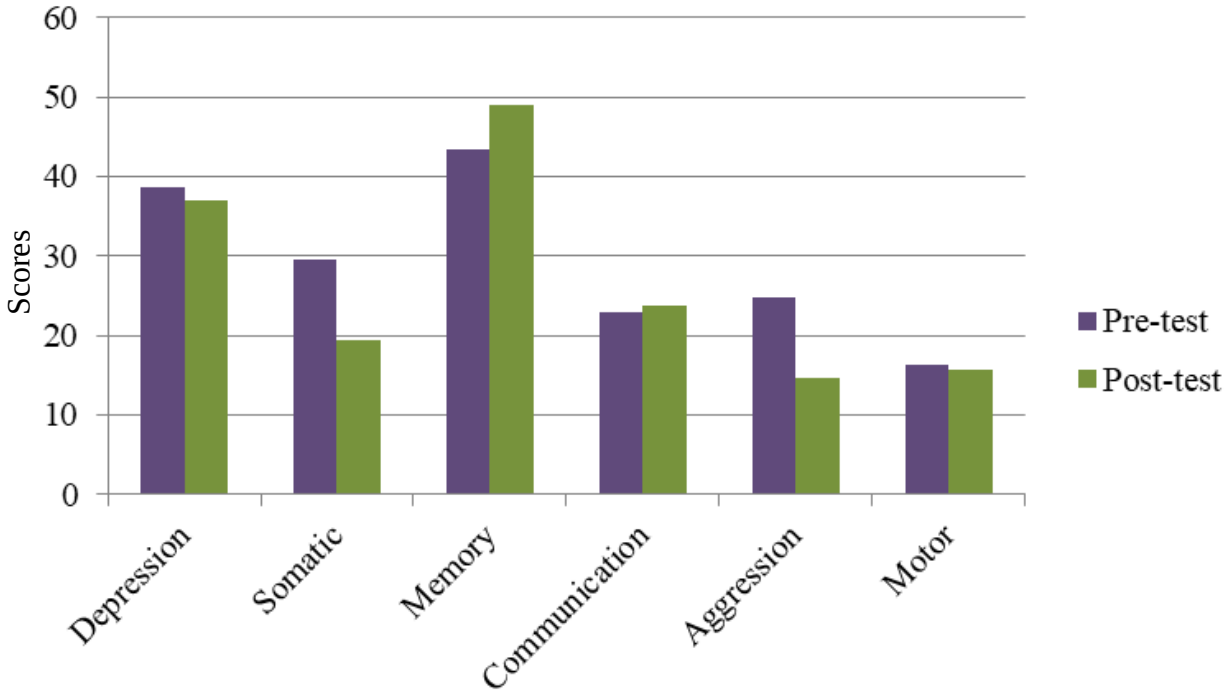

Table 6.5 shows the pre and post test scores on the Neuro-Behavioural Functioning of people with AUD in the control condition, i.e., in the absence of intervention.

On the dimensions Depression, Somatic, Aggression and Motor, there is an enhancement in the Neuro-Behavioural Functioning of the sample, with a decrease in the scores from 38.74 to 36.94, 29.65 to 19.48, 24.84 to 14.61 and 16.35 to 15.65, where the difference is significant ($p<0.01$) on Somatic and Aggression dimensions shown by the paired sample t-test. In terms of Memory and Communication it is seen that there is an increase in the mean scores at the post test condition from 43.48 to 49.06 and 22.87 to 23.84 showing a decline in the Neuro-Behavioural Functioning, the difference significant ($p<0.01$) shown by the t value.

During abstinence from alcohol, the body undergoes reversal of the biological damage naturally due to the ability of the body to heal itself due to plasticity (Gould, 2007) and the ability of other cells to take over the functions of the repaired cells (Fuchs & Flugge, 2014). Though the body repairs itself automatically, the degree of change is found to be minimal in the

absence of psychological therapy, hence stating the need for intervention to remediate the Neuro-Behavioural Functioning Abilities in addition to the Cognitive Abilities.

Hence, the hypothesis stating that ‘the developed therapeutic module will be effective in enhancing the Neuro-Behavioural Functioning of the sample’ has been accepted.

The following tables show the between group comparison of the effectiveness of different therapeutic interventions applied in bringing about enhancement on the Neuro-Behavioural Functioning of people with AUD in terms of the different dimensions. The sample randomized into five different groups were provided therapy using the art forms Colouring, Music, Story-Telling, the relational effect of the three forms and the fifth group received therapy after collection of the post-test data, treated as a wait-list control group.

Table 7.1

Effect of Intervention on the Dimension Depression of People with AUD

N=155

Depression	Sum of Squares	df	Mean Square	F value	Post hoc
Between subject	1738.917	4	434.729		Colouring > HACRT > Music > Story-Telling > Control group
Within subject	3554.270	150	23.695	18.347*	
Total	5293.187	154			

*Significant at 0.01 level

Figure 6.1

Effect of Intervention on the Dimension Depression of People with AUD

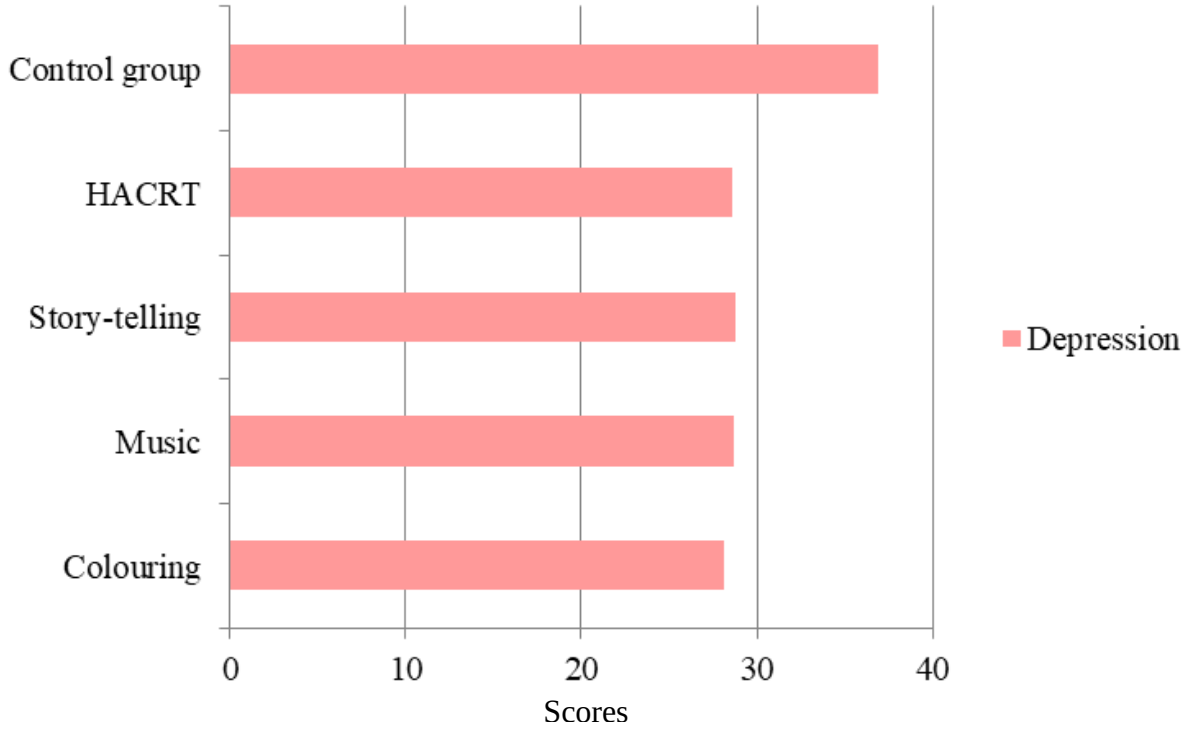

Table 7.1and figure 6.1 show the comparison between the different art forms in bringing about enhancement in the Neuro-Behavioural Functioning of people with AUD on the dimension Depression. The Scores of the one-way ANOVA ($F(4,150)=18.347$) show that there is a significant difference ($p<0.01$) in the changes brought about by the different therapeutic interventions on the Depression levels of people with AUD. This shows that different modules of therapy produce different extents of change.

The Duncan Post hoc shows the intensity of enhancement brought about by the different therapeutic art forms, where Colouring ($\mu=28.16$) has been the most effective, followed by HACRT ($\mu=28.63$), Music ($\mu=28.73$) and Story-Telling ($\mu=28.81$). Though the different interventions have produced significantly different benefits, the results are almost similar. Music brings about a calming effect in the brain (Thoma et al., 2013) and Story-Telling provides space for venting out of one's emotions (Pasupathi et al., 2016), hence helping in easing oneself from depression. In the no treatment ($\mu=36.94$) condition, there is a marginal betterment when

compared to the pre-test condition, showing that therapy is required to deal effectively with the feelings of depression.

Table 7.2

Effect of Intervention on the Dimension Somatic of People with AUD

N=155

Somatic	Sum of Squares	df	Mean Square	F value	Post hoc
Between subject	296.543	4	74.136	6.673*	Story-Telling > HACRT > Music > Colouring > Control group
Within subject	1666.554	150	11.110		
Total	1963.097	154			

*Significant at 0.01 level

Figure 6.2

Effect of Intervention on the Dimension Somatic of People with AUD

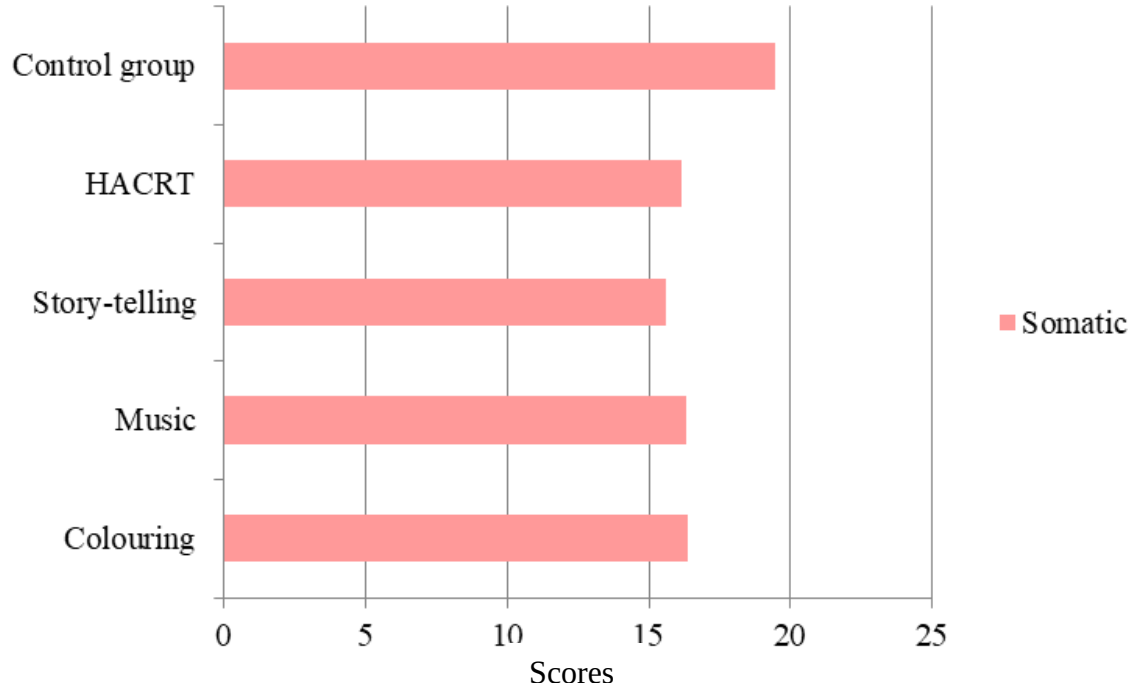

Table 7.2 and figure 6.2 show the between group and within group comparison of the different therapeutic art forms in enhancing Neuro-Behavioural Functioning of people with AUD on the dimension of Somatic functioning. The F value calculated using the one-way ANOVA ($F(4, 150)=6.673$) shows that Colouring, Music, Story-Telling and HACRT have been significantly different ($p<0.01$) in bringing about change in the somatic area of functioning.

The above observations were further analysed using the Duncan Post hoc analysis. The values show that Story-Telling ($\mu=15.58$) has been the most effective strategy in dealing with the Somatic symptoms, followed by the strategies of HACRT ($\mu=16.13$), Music ($\mu=16.33$) and Colouring ($\mu=16.35$). The space provided by the activity of narrating stories helps individuals in venting out their emotions and dealing with thoughts more objectively, which has an effect on the body, substantiated by the mind-body interaction (Vazquez, n.d.). Though the control group ($\mu=19.48$) has shown a betterment on terms of the Somatic functioning, the strength of improvement is lesser compared to the other groups, showing that faster recovery can be attained through exposure to therapeutic intervention.

Table 7.3

Effect of Intervention on the Dimension Memory of People with AUD

N=155

Memory	**Sum of Squares**	**Df**	**Mean Square**	**F value**	**Post hoc**
Between subject	9459.736	4	2364.934	27.926*	Music > Colouring > HACRT > Story-Telling > Control group
Within subject	12703.013	150	84.687		
Total	22162.748	154			

*Significant at 0.01 level

Figure 6.3

Effect of Intervention on the Dimension Memory of People with AUD

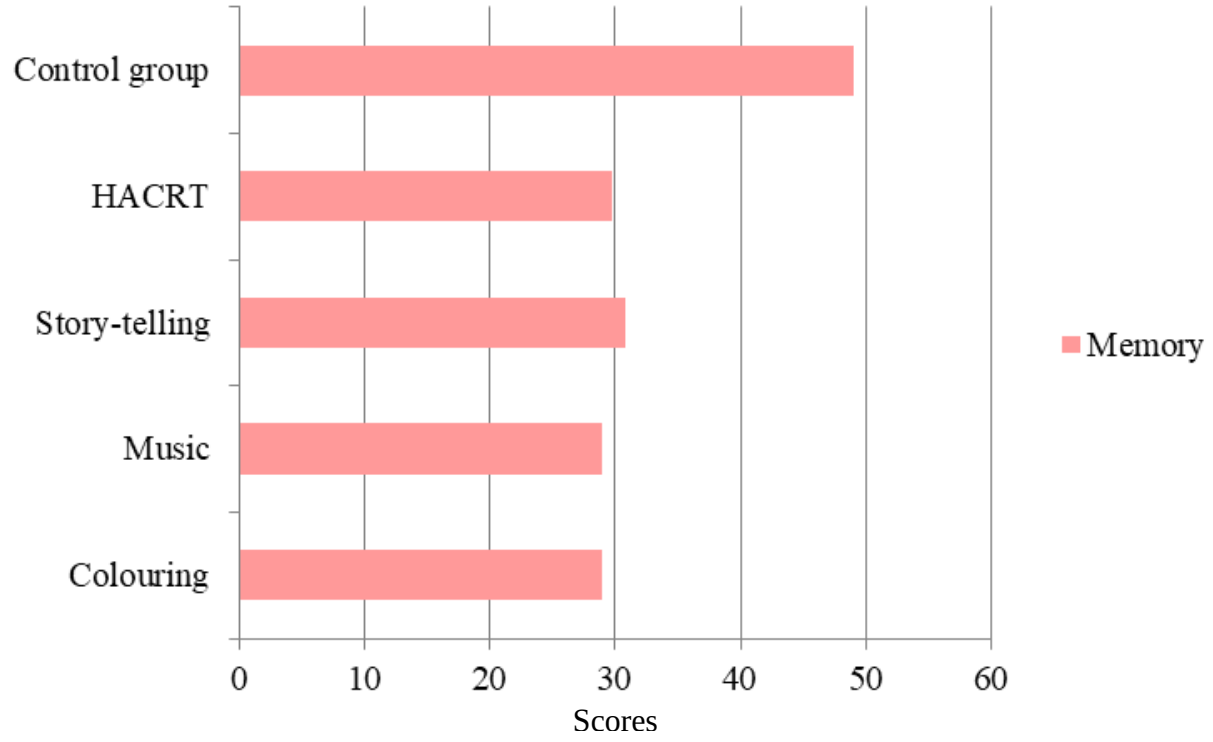

Table 7.3 and figure 6.3 show the between subject and within subject comparisons on the dimension Memory of the Neuro-Behavioural Functioning of people with AUD at the post test condition, as an effect of the different forms of therapy provided to the sample. The one-way ANOVA ($F(4, 150)=27.926$) employed in analyzing the difference between the two conditions show that there is a significant difference ($p<0.01$) on Memory and related functions under the influence of all the four therapeutic forms and in the control condition.

The intensity of change experienced by the different groups which underwent different therapies is shown by the Duncan Post hoc. The values show that Music ($\mu=28.93$) has been the most effective in enhancing Memory, followed by Colouring ($\mu=28.94$), HACRT ($\mu=29.78$) and Story-Telling ($\mu=30.74$). Music, presented as a combination of instrumental music and binaural beats is effective in stimulating the brain in addition to producing a relaxing effect (Ramdinmawii & Mittal, 2017). In the control group ($\mu=49.06$), the decline in ability as

compared to the pre-test condition can be related to the neuronal damage caused as an effect of alcohol use.

Table 7.4

Effect of Intervention on the Dimension Communication of People with AUD

N=155

Communication	Sum of Squares	Df	Mean Square	F value	Post hoc
Between subject	3653.374	4	913.344		HACRT > Music > Colouring > Story-Telling > Control group
Within subject	1954.213	150	13.028	70.106*	
Total	5607.587	154			

*Significant at 0.01 level

Figure 6.4

Effect of Intervention on the Dimension Communication of People with AUD

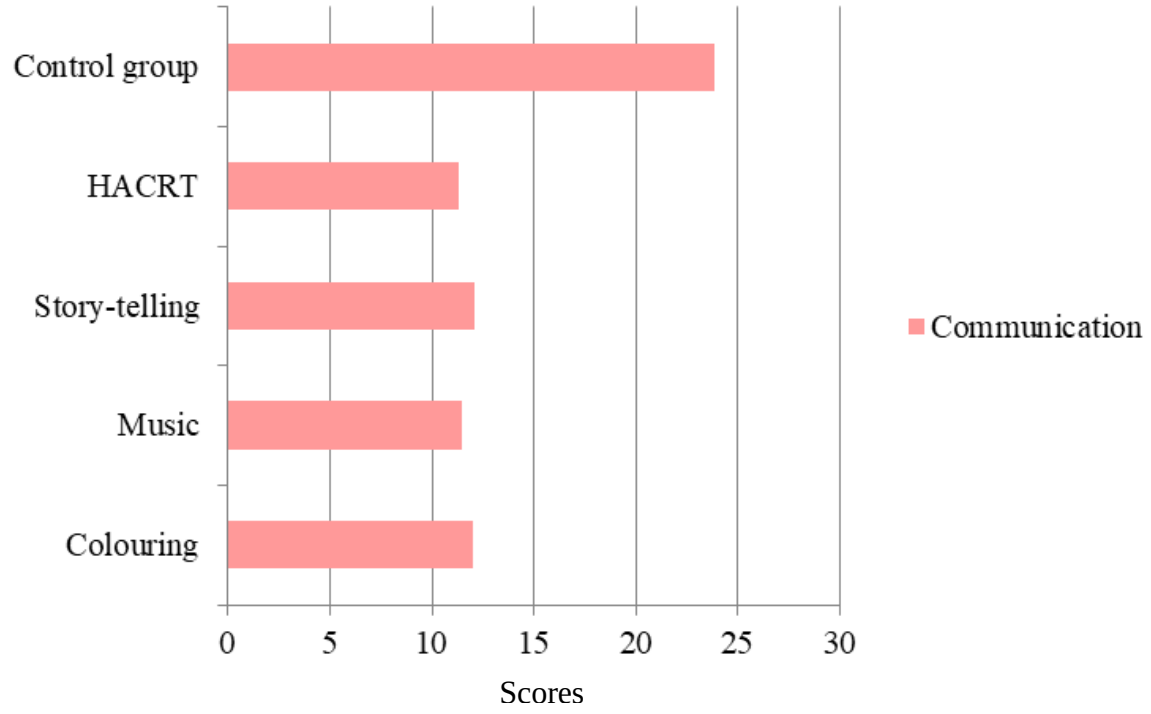

Table 7.4 and figure 6.4 show the effect of the different therapeutic modules on the dimension Communication of the Neuro-Behavioural Functioning in people with AUD. The one-way ANOVA ($F(4,150)=70.106$) shows that all the five groups show a significant difference ($p<0.01$) in the Communication abilities post the reception of therapeutic intervention.

The variations between the different therapeutic conditions were furthered by the analysis using the Duncan Post hoc. The results show that HACRT ($\mu=11.31$) has been the most effective, followed by Music ($\mu=11.47$), Colouring ($\mu=12.03$) and Story-Telling ($\mu=12.10$). Though Story-Telling involves practice of verbal communication, it has not been effective in bringing about the desired change. Challenges in developing communication abilities might be due to the lack of interest in the interacting with others, deficits at the neural level hindering communication or the lack of necessary skills of self-expression (Tisljar-Szabo et al., 2013). Decline in the Communicative abilities in the no treatment condition ($\mu=23.84$) shows that therapeutic intervention is required to rehabilitate the damage caused by alcohol on the neuronal cells.

Table 7.5

Effect of Intervention on the Dimension Aggression of People with AUD

N=155

Aggression	**Sum of Squares**	**Df**	**Mean Square**	**F value**	**Post hoc**
Between subject	447.292	4	111.823	12.985*	Colouring > Music > HACRT > Story-Telling > Control group
Within subject	1291.779	150	8.612		
Total	1739.071	154			

*Significant at 0.01 level

Figure 6.5

Effect of Intervention on the Dimension Aggression of People with AUD

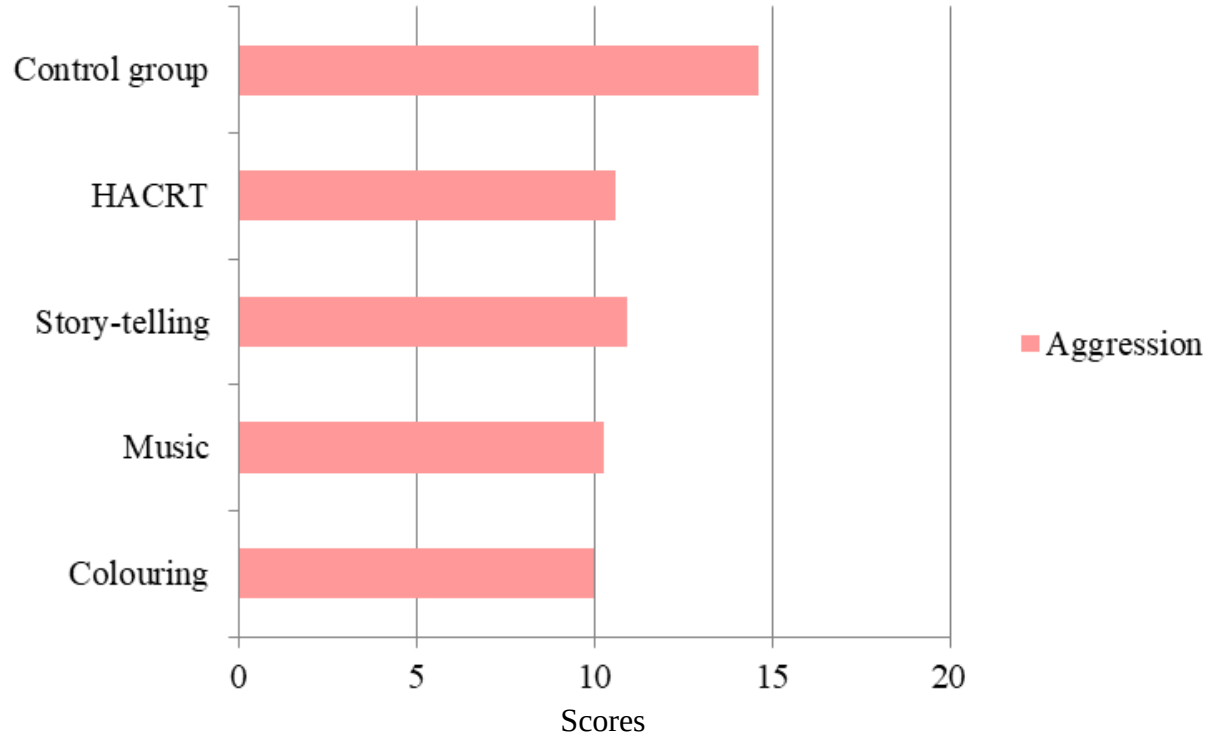

Table 7.5 and figure 6.5 show the scores on the dimension Aggression of the Neuro-Behavioural Functioning of people with AUD after the application of the different therapeutic forms and the waitlist control condition. The results of the one-way ANOVA ($F(4,150=12.985)$) show that there are significant differences ($p<0.01$) in Aggressive behaviour shown by people with AUD after the implementation of the developed therapeutic art forms.

The Duncan Post hoc conditions show that Colouring ($\mu=9.97$) has been the most effective in reducing the Aggressive behaviour of people with AUD, followed by Music ($\mu=10.27$), HACRT ($\mu=10.59$) and Story-Telling ($\mu=10.94$). Though the control group ($\mu=14.61$) did not receive intervention, there has been a significant reduction in the Aggressive nature compared to the pre-test condition, which might be associated to increased impulse control and response inhibition, in the absence of the substance (Miczek et al., 2015).

Table 7.6

Effect of Intervention on the Dimension Motor of People with AUD

N=155

Motor	Sum of Squares	df	Mean Square	F value	Post hoc
Between subject	695.253	4	173.813		Colouring > HACRT > Music > Story-Telling > Control group
Within subject	528.644	150	3.524	49.319*	
Total	1223.897	154			

*Significant at 0.01 level

Figure 6.6

Effect of Intervention on the Dimension Motor of People with AUD

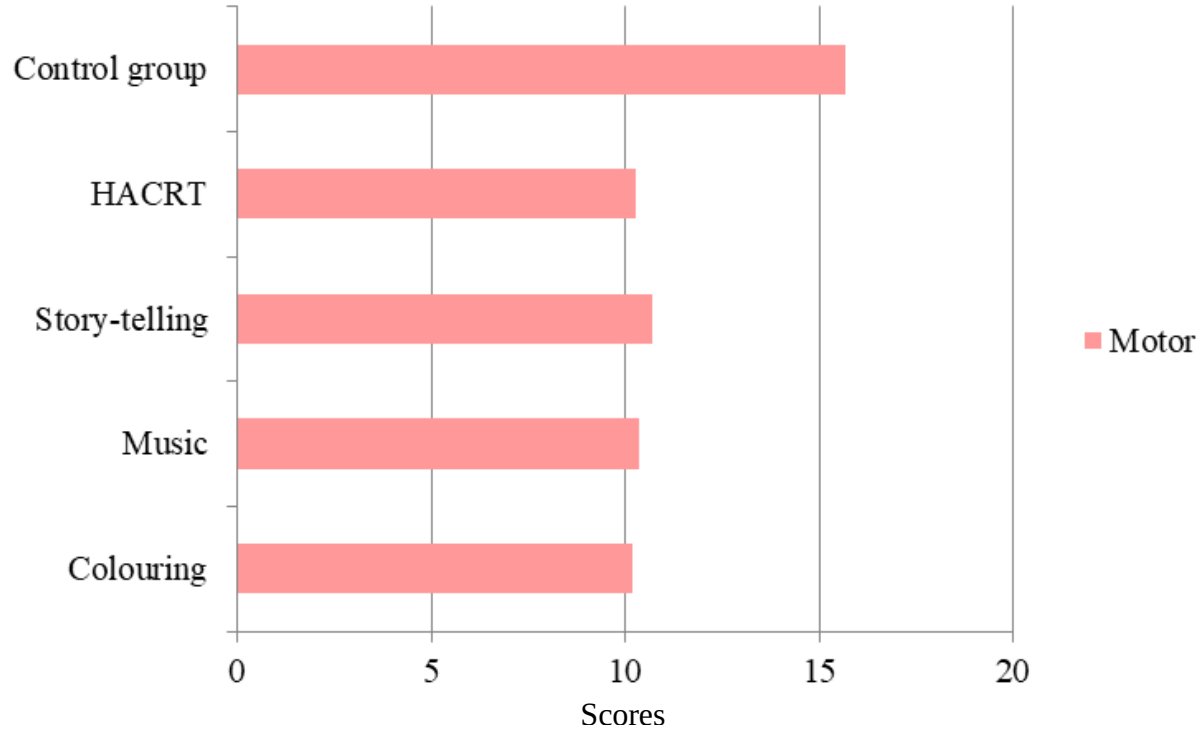

Table 7.6 and figure 6.6 show the scores on the dimension Motor of the Neuro-Behavioural Functioning of people with AUD in the post test conditions compared at the between subject and within subjects levels, showing the effectiveness of the different therapeutic interventions. The F score on the one-way ANOVA ($F(4,150)=49.319$) shows that there is a significant difference ($p<0.01$) in the extent of improvement of Motor functioning of the sample as an effect of the different art forms offered as therapy.

The value of the Duncan Post hoc analysis shows that Colouring ($\mu=10.16$) has been the most effective therapeutic art from in enhancing the Motor dimension of the Neuro-Behavioural Functioning, followed by HACRT ($\mu=10.25$), Music ($\mu=10.37$) and Story-Telling ($\mu=10.71$). Music having a stimulating effect on the brain, regulates the homeostasis of neuronal transmission, repairing the neural cells and thereby enhancing functioning on an overall level (Hatampour et al., 2011). In terms of the control group ($\mu=15.65$), there is a negligible enhancement in the motor functioning after the forty-eight day period, showing the need for intervention to enhance functioning.

Hence, the hypothesis stating that ‘HACRT will be more effective in enhancing the Neuro-Behavioural Functioning of people with AUD’ has been partially accepted, as different art forms were more efficient in enhancing different dimensions of functioning.

Research conducted on AUD shows deficiencies in the cognitive abilities of individuals who consume alcohol not only on a regular basis, but even in milder doses occasionally. The chemical combination of the substance is found to bind with the oxygen molecules after disintegration resulting in lesser oxygen supply to the brain and other parts of the body, thus leading to the death of the cells. In the brain, death of neurons leads to reduction in the processing capacity of the different areas, causing a downfall in the cognitive abilities. In the long run, increased neuronal death is caused, resulting in greater deficit in the cognitive abilities.

Increased awareness related to the management of AUD through de-addiction treatment, the number of individuals opting for treatment is constantly rising, relative to the increase in the consumption of the substance. Though different treatment strategies such as psychopharmacological treatment, AA, faith healing and different psychotherapeutic treatments are available, there is not much concentration on the rehabilitation of the cognitive abilities. Rehabilitation of cognitive abilities is not only necessary for reintegrating the treated individual into the society, but also to maintain a positive prognosis of the condition, without which the risk of relapse is high. Hence, inclusion of cognitive remediation is a necessary part of de-addiction treatment in order to ensure that an individual stays safe from relapse and also prepares himself/herself for getting back to an active life.

The present study intended to devise a technique for the rehabilitation of Cognitive Abilities in people with AUD. The study was devised to be conducted in three phases, the pilot phase to widen the understanding of the study sample, phase-I to explore the Cognitive Abilities of the sample at the pre-test condition and the phase-II of the study involving the application of the intervention and the identification of its effectiveness. Before the formulation of the treatment, it was found necessary to explore the cognitive abilities of individuals with AUD. This helped in understanding the deficits experienced by them and their requirements in terms of therapy, so as to develop a module that would interest the takers.

A pilot study was conducted for understanding, not only the Cognitive Abilities of the sample, but also to comprehend their mindset and their common experiences. Assessment of Cognitive Abilities were done using the Addenbrooke's Cognitive Examination- Revised, so as to understand their abilities in the areas of orientation to surrounding, ability to form new memories, attention, recalling old memories, language comprehension, reading, writing, fluency,

naming of objects, fine motor skills, perceptual abilities and visuo-spatial abilities. The results of the assessment led to the choice of the eight variables included in the study, covering the common deficits and identification of the respective tools. The tools were translated into the regional language, Tamil and cross-translated to English so as to verify the correctness and genuineness of the translation.

The interviews conducted during the Pilot study led to probing further into the experiences of the people with AUD. Most individuals expressed feelings of inferiority, lack of motivation and boredom associated to a mechanical lifestyle. The treatment module was developed which aimed at incorporating strategies that would be both motivating and well entertaining in nature. A scrutiny of previous literature was conducted so as to identify a form of therapy which would cater to the requirements expressed by the sample. It was necessary that the application of the developed therapeutic module be user friendly, time and cost effective and readily practicable by the sample, even in the absence of therapeutic supervision.

Considering the above stated factors, Art Therapy was identified as the most appropriate form of therapy that can be applied. The materials were collected, compiled and the intervention module was prepared. In order to evaluate the developed module, multiple experts in the field of de-addiction treatment rated the module and gave valuable inputs which were incorporated and necessary updates were made. The duration of intervention was fixed to be 48 consecutive days, based on literature and the suggestion of experts.

The present research involved selection of the location, source of data and sample based on the inclusion and exclusion criteria. Owing to the necessity of meeting the sample for about fifty consecutive days, it was decided that data be collected from treatment centres which offered in-house treatment based on the principles of AA, housing each individual for three consecutive months. This helped me to access the sample in a safe environment, under the supervision of trained professionals in the field and also allowed for meeting them on a regular basis.

Different treatment centres at different geographical locations across the state of Tamil Nadu were contacted and permission sought for the conduction of the study. After presentation of the proposal to the Board of Management of the treatment centres and discussions with the

professionals at the respective centres, a private de-addiction centre at Madurai district, Tamil Nadu was chosen for conducting the study.

After approval, the staffs at the centre were briefed about the process of the research seeking their cooperation. The in-mates of the de-addiction centre, those in the post-detoxification phase were addressed upon the purpose of the study and were informed of the process. They were included in the study based on their willingness to participate in the research. The subjects were then met on a one-to-one basis and briefed about the study in detail. On building a rapport, socio-demographic data and the pre-test data were collected.

Initially the subjects were hesitant to take part in the research as it involved extra efforts by them besides their usual routine, but they were cooperative throughout. As they started performing the cognitive assessments, they found it interesting and were involved in the completion of the tasks. The demeanour of the subjects varied extensively. Some clients were extensively verbal, showed a heightened sense of self and were over confident about their abilities, whereas others were timid, felt inferior and were restrictive on their verbal as well as non-verbal exchanges. These extremities of personal expression tended to regulate as interactions progressed.

Most subjects had an insight on their disordered state, with a realization of the damage they had caused to self and others by their drinking behaviour. Regret and guilt were the commonly observed emotions among them. Few clients were arrogant in their attitude, showing remorse and anger as an outward expression of their personal helplessness. They blamed their family, friends and the society for their sorry state and had no awareness of the damage caused by them to others. A wide range of individual differences were observed in the sample, which was reflected in their thought patterns, emotions and the way they expressed them.

When performing the assessment on the Cognitive Abilities, most subjects found it challenging to complete the tasks. Both inability to perform as well as disinterest was expressed. On the Verbal Fluency task the subjects were asked to recall the maximum number of words which started with a particular letter, for example, letter K, whereas in the Categorical Fluency task they were asked to relate words belonging to the same category, for example, animals. They found it difficult to recall words associated to letter sounds, but performed better on the

categorical fluency task where words of the same category were cued by the mental template they possessed. In the Verbal Fluency activity, they did not have any associating factor between the words except for the sound of the starting letter. This showed that there was higher extent of damage in relation to explicit memory rather than implicit memory, where sequential and cued recall are possible.

On the Trail-Making Task (Part-A), aimed at measuring Attention, they were asked to draw lines connecting consecutive numbers from one to twenty-five. Few of them had a poor grip of the pencil, as their hands were shaky and thus drew wobbly lines. They found it difficult to concentrate on the task and got frequently distracted, also due to their inability to recall the correct sequence of the numbers. Few individuals expressed self-doubts about their ability in performing the task whereas others wanted to prove their abilities to show that the drinking behaviour had left their abilities undisturbed. This showed that in spite of the damage caused by the addictive behaviour, the pleasure attained out of the high was much sought after.

The O'Connor Finger Dexterity test was administered to measure the Fine Motor Skills. The subjects struggled to insert three pins together into each hole due to lack of the fine motor ability of gripping and due to the shivering of hands. They were hence asked to insert one pin in each hole, which in itself was a challenge. Most of them were observed to insert the pins in a random manner taking a longer time to complete the task. This represented a damage in the frontal lobe where the higher mental abilities are seated.

For the measurement of Working Memory, they were presented with the Digit Span Test, where most of them performed well on the digit forward task, but had difficulty in the digit backward task. They found it challenging as the number of units in the chunk increased. Though immediate memory was found to be intact in most samples, a higher order of the memory task was found to be unaccomplished, thus showing the reduction in the working memory ability. Those with an educational qualification above schooling and those who worked with numbers frequently were observed to perform better on this task, showing education and practice to be protective factors.

When exposed to the mobile application to measure the Reaction Time, difficulty was present in the first trial, but with the following trials performance levels slightly improved. Delay

in response was more often due to their psychomotor retardation rather than the inability to perceive the stimulus. The subjects expressed difficulty in reaching out to the mobile screen and making a touch that was sensitive enough for the device to recognize it. They stated that they were not able to sense if they had made a soft touch or a strong enough touch that could be sensed.

On the Digit Letter Substitution Task, they felt that the substitution activity might be difficult to perform. Most of them showed a low speed of substituting the digits, having to verify the reference list for each trial. This showed that they not only had a deficit in Perceptual Speed and Accuracy, but also in their Working Memory. Lack of confidence in their ability to complete the task was also found to inhibit their performance, and feared that they would faulter.

Though each of the tests given consumed very little time to complete, the sample felt that there was too much exertion on their mental abilities, each of the tasks seemed demanding in terms of the effort needed to complete them. Few subjects expressed that their ego did not permit them to fail in the task, especially as I was of the opposite gender, which made them get anxious, impacting their performance on the tests. The impact of the inferiority feelings commonly possessed by individuals with addictive behaviour, as a response gets developed into a superiority complex, making them grow an unrealistic evaluation of themselves.

Few samples who had difficulty in performing the tasks complained that lighting was inadequate though seated in a well-lit room, being provided with a pencil and not a pen for completing the writing and drawing tasks and that their hands being sweaty due to which they took a longer duration to complete the tasks. These excuses portrayed their nature of being unable to accept reality and the false belief they had on their abilities to withstand the ill-effects of alcohol.

From the performance of the participants on the tasks and the verbal exchanges it could be clearly observed how thoughts, feelings and beliefs have an impact on the cognitive abilities and vice versa. This reiterates the need for devising a holistic treatment strategy such that the rehabilitation caters to all domains. Relapse can be controlled when the remediation provided is multi-dimensional in nature. This will enable the enhancement of the overall functioning of the individuals.

Once the pre-test data was collected, the sample were randomly assigned into five different groups for the next phase of the study, the intervention phase. Intervention was provided to each group separately, the first group receiving Colouring, the second group Music, the third group Story-Telling and the fourth group HACRT i.e., a combination of all the three art forms, whereas the fifth group was provided therapy after collection of the post-test data, considered as the waitlist-control group.

When exposed to the different therapeutic art forms, the subjects were at the outset not highly receptive, but slowly developed interest in performing the activities progressively. Though during the initial days it was required to organize them deliberately, with practice they assembled in the respective place without insistence, provided the time was intimated the previous day. This showed that the sample were interested in going through the process of the therapeutic intervention using the different art forms.

In the Colouring activity, the early pictures involved wider spaces and the complexity of the images increased with each successive image. At first, the participants were provided with wax crayons, which they broke often due to the stress they laid on the crayon. As a remedial measure, they were then provided with plastic crayons, which sustained pressure to a greater extent, but still broke when force was applied. As days progressed, the amount of pressure put by the subjects on the crayons reduced, indicating an achievement of relaxation through the therapeutic intervention.

During the early stage of therapy, few subjects experienced shivering of hands, which eventually reduced. Some subjects had difficulty in recalling the appropriate colour for the picture presented whereas few others had trouble with naming the colours they used. With regular exercise, there was a reduction in these tendencies. Subjects also developed the knack of shading within the outlines with practice and were able to have a better control over their hand movements when they shaded the pictures. As the complexity of the pictures grew, practice helped them to shade within the minute areas tactfully.

In the group exposed to Music, the subjects had to be repeatedly instructed on keeping their eyes closed as they listened to the audio track. As days passed, there was an observable improvement on their attentive capacity, shown by their ability to concentrate on the audio being

played without opening their eyes or without fidgeting their hands, etc. Few subjects reported that the beats and the tune of the music elicited vivid pictures in their minds and few subjects were able to recall long-forgotten memories as they listened to the music. It was also reported that the subjects felt relaxed listening to the parts of the audio which contained instrumental music and felt energized during listening to the parts which had a combination of the binaural beats.

Story-Telling as an intervention was received with mixed views from the subjects. Some participants were highly interested in the activity and were appreciative of the space provided to share their imaginations in the form of stories. Other subjects found the activity not very interesting as they had difficulty in building their ideas in the form of a story whereas others found it challenging to effectively conceive live characters that suited the plot of the story. Individuals who had inability in accepting their true self and those who showed fluctuations in their emotions tended to settle as they expressed their thoughts through the story telling activity.

Subjects also possessed fear of evaluation when they shared their stories in the group. During the first few days of narrating a story relevant to the picture presented, it was observed that stories resembled those of movie plots and there was repetition in the main idea of the stories narrated by the subjects. As therapy progressed, subjects were improving on their ability to build stories, inserting sudden twists in the story, including dialogues which possessed depth of meaning and even used fictional ideas in the construction of the stories. The group started enjoying the process of building the stories with their imagination and felt motivated when the group members applauded their abilities.

The fourth group, was exposed to all the three therapeutic interventions as a combination, hence they were asked to colour a picture, listen to the audio track and narrate a story based on the presented picture. Due to the time constraints faced at the treatment centre, subjects were asked to perform the activities at a stretch without breaks in between, which caused a negative impact on the effectiveness of the therapy, making the participants feel strained by the activities.

When the art forms were presented together, the subjects found Colouring the most interesting. Majority of them enjoyed listening to the Music, but Story-Telling occurred to be the least sought activity of the three. Subjects expressed interest in involving in the Colouring task

for a longer duration, as they were able to connect to their childhood memories when involving in the colouring activity. They stated that they would be interested in continuing the colouring activity after getting discharged from the treatment program, as they were not aware of the beneficial effects of colouring before involving in the activity.

Though it was expected that the combination of the three art forms would be more effective in bringing about change, the results showed that the extent of impact created was similar to those of the individual tasks. This might be due to the subjects having been exposed to the tasks one after the other without a break. The art forms though recreational and entertaining, the interest of the participants played a major role in its success, which might be a reason for its lesser than expected effectiveness.

Through the period of intervention the relationship between the participants and me was strengthened, thus motivating them to share their personal experiences and concerns. Individuals were randomly assigned to groups, all groups had participants who showed different thought and emotional patterns. The moderating effect produced by intervention of their cognitive abilities as well as distortions were readily observable.

In addition to experiences reported by the subjects, the staffs and other counsellors working at the centre reported that those undergoing the intervention were observed to be more punctual on their schedule and also seemed to show a regularized sleep cycle. Improvement on functioning was asserted in the statistical analysis, showing the effectiveness of the therapeutic art forms in bringing about cognitive remediation and enhancement in Neuro-Behavioural Functioning. Hence it was observed that the therapeutic intervention enhanced functioning not only in a singular domain but led to an overall improvement.

The subjects were tested on the same set of cognitive tasks and neuro-behavioural assessment at the post-intervention condition. They showed a clearly observable change in their performance at the post-test condition. The subjects seemed more confident than before to complete the tasks assigned, which reduced their anxiety levels while performing them. Their physical as well psychological states appeared to influence their performance on the cognitive tasks positively, resulting in an enhancement of their abilities, control over their thought, feelings and behaviour, in addition to a positive motivational state.

In the control group, which was tested for enhancement in the Cognitive Abilities post detoxification, without any psychological treatment, betterment was seen on a few variables. Though there was a significant change in the Cognitive Abilities of Attention, Working Memory, Reaction Time, Perceptual Speed and Perceptual Accuracy, the intensity of change was negligible in all cases. This marginal improvement on the Cognitive Abilities can be attributed to the reversal of the biological changes caused in the brain after cessation of alcohol consumption.

When discontinuing alcohol use, the body exhibits withdrawal symptoms, which is an outcome of the body's accommodation to functioning without the presence of alcohol. During the twenty-one day period of detoxification, the body recovers itself from the physiological damage caused by alcohol, in terms of attaining a balance of the neurotransmitters and other chemicals, enhancing plasticity of the cells and improving the functioning of the transmission channels. These improvements in the physiological health of an individual, also transfers to his/her Cognitive and Neuro-Behavioural Functioning, which has been reflected in the enhancement of ability in the control group.

In addition to the biological changes, the treatment produced at the de-addiction centre also brings about certain changes in the individual. Inmates of the centre are provided with a routine schedule, which they practice every day once admitted to the treatment program. They are brought into healthy habits such as waking up early, performing physical exercises and yoga, following the tenets of AA, undergoing psycho-educational sessions, involving in group activities of sharing their problems and venting out their emotions as well as consuming a balanced diet. These regularizations brought about in the life style of a previously alcohol-using person also led to the marginal change in the control group.

The different art forms had been effective in remediating the Cognitive Abilities of people with AUD. In addition, improvement has also been attained in other domains, such as the intrapersonal, interpersonal, emotional and social domains of functioning. The different art forms acted as a means through which the participants were able to vent out their pent up emotions and thoughts. Colouring helped them in visual expression through the use of different colours and in the physical exercise of their emotions, observed through the pressure laid by them on the crayons. Colouring seen as an activity for children helped in bringing out the inner child in the participants, breaking the monotony of adult life. Being able to enjoy an activity by itself was

therapeutic in nature, especially for those individuals who were burdened by the addictive condition.

Music provided a relaxation from the psychological and physical tension experienced by them, directing them at being mindful when listening to the music. The combination of the instrumental music being soothing in nature and the binaural beats being stimulating in nature helped the participants to reach a state of trance, following which their cognitive state was aroused. This according to the principle of hypnotism produced change at the unconscious level, the experience being deeper and effective. The alternating pattern of the music being calming and exciting also helped in regulating the anxiety aroused as a result of recalling past memories.

Story-Telling provided a space for the participants to share their thoughts, experiences and feelings in a non-judgmental manner, as it was a safe space for them to project themselves upon characters they built. Narrating what they felt helped in venting out as well as gaining more clarity and direction to the thoughts which did not have a clear form previously. Lack of social support and not being heard being major challenges to the mental health of people with AUD, this activity was effective in encouraging them to speak.

The art forms were thus able to provide a sense of self to the participants, letting them express without any inhibitions. It helped in encouraging them to add value to their thoughts and feelings, giving shape to them through the activities performed. The intervention being more open provided value to the personalised needs of the individual, letting them experience the changes more practically rather than having to conceive them mentally. Lesser stigma associated with the art forms is an added advantage, where the intervening effect is provided by a more accepted activity rather than traditional psychotherapy.