

The Impact of Light-Sound Stimulation on Intelligence in Teenagers

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These days mind power techniques are very effective to stimulate the cognitive aspects of an individual. These techniques could be very much effective for the teenagers to achieve their goals in the life because today is the world of competition and every individual wants to go for higher profiles. So this path of Light-Sound stimulation seems to be the best for the teenagers. A sample of 120 students was selected from teenage group i.e. 13 to 19 years of both sexes belonging to middle socio-economic status by purposive random sampling technique. The experimental condition was further divided into three experimental groups and was administered three different treatments of mind power techniques i.e. sound, light and light-sound through mind power music and mind machines. The scores of Intelligence showed a significant difference between the entire experimental groups and control group. The maximum score was observed for Light-Sound stimulation followed by light and sound stimulation.

Keywords: Mind Machines, Light Sound Stimulation, Audio Visual Stimulation

Introduction

There is no clear boundary to define the teenage years, particularly in our society. Simpler societies often have widely recognised or even formal rites of passage to mark the transition from childhood to teenage or from teenage to adulthood. Some even make a direct transition from childhood, not recognizing teenage as an intervening stage. Many of these rites of passage are far from appealing. They may involve proving oneself by living alone in the wilderness or submitting to painful ordeals, sometimes exotic ones such as scarification of the sex organs (Young, 1965)¹. However, these rites of passage into adulthood do save youths from most of the confusion and frustration of attempting to find themselves. The cognitive development, particularly the attainment of formal operations, allows teenagers to deal with abstract concepts in mathematics, logic and philosophy. These new abilities also allow teenagers to see some of the contradictions and falsehoods embedded in their previously accepted beliefs and attitudes. New intellectual abilities and independence from parents also mean that teenagers are exposed to new reference groups

that provide conflicting directions of influence. Much time is spent trying to sort out personal beliefs, parental beliefs and religious teachings. Ultimately, teenagers must resolve these conflicts and arrive at an internally consistent and satisfying set of beliefs, attitudes, expectations, and behaviours. This multifaceted process has been called the adolescent identity crisis (Erikson, 1968)².

Teenage is typically a time of turmoil in our society. Much of the reason of this is the fluidity and openness of a society that offers many opportunities but also many choices. Choices and changes come in rapid succession in teenage the relatively carefree stability of middle childhood breaks down as the teenagers enters a period of intense preoccupation with self and search for identity. Changes in physical and cognitive abilities and social milieu introduce both new challenges and new problems. The transition state of mind among the teenagers disturbs or enhances their psychological get up to visualize, attain and conceive the surroundings which turns into the positive or negative direction of development. In the present research investigation mind power has been taken as an important dominating factor for behavioural manifestation. Therefore, the stated discussion emphasizes the use of electronic light-sound devices to activate the brain to gain more cognition which may

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enhance sensory motor activities to attain and memorise more about behavioural correlates. As psychologists states that the cognitions received through sensory organs go to the brain and affect an organism. These cognitions develop an emotional stage, which manipulates psychomotor activities. So it is clear that the brain (Mind) plays a wholesome role to direct behaviour. The behaviour is always manifested by cognition and affection leads in strengthening of stimulus-response (S-R) bonds. These bonds facilitate smooth learning. It may be positive or negative; it depends on the socialisation pattern of organism, their experiences and interactions with surroundings. Light and sound (L-S) technology is successful because the two greatest needs of our brain are nutrition and light. The brain must rely on its ability to transform the energy from light for survival. When this source of energy is not readily available from the sun, a substitute must be found to allow our brain to provide us with necessary energy. A reliable substitute is audio visual stimulation technology. Sound can have profound effects on people. Although sounds appear to be a personal experience, humans around the world are hard-wired to have similar experiences to certain sounds. The sound of chirping birds in a forest produces even harmonics and will be more relaxing than the sounds from a factory (odd harmonics), not just because of the associations people make with sounds of nature versus factories, but also because of the harmonic content

The brain uses any light energy force to expand cognitive ability for motor learning, creativity insight and redirection of psychological scripts. We all rely on this source for continuous mental alertness and winning performance. Light and sound technology operates on electric frequencies called Hertz (Hz) or cycles per second. The brain operates on frequency with each brain wave having a specified Hz or cycles per second. The lights and sounds teach the brain to seek out the desired brain wave frequency creating the optimal, desired state for relaxing, visualizing, sleeping, high performance, synchrony, etc.

Brain Waves

Brain waves have been categorized into four basic groups: beta, alpha, theta and delta. These categories are associated with the rapidity of oscillation (frequency) of brainwaves. As it turns out, certain patterns of brainwave activity are also associated with specific mental states.

Beta

Beta is associated with normal, waking consciousness; attention directed towards the external environment. We are most likely in the *beta state* as we read this. Beta waves oscillate between approximately 14 and 30 times per second (Hz).

Alpha

Alpha is relaxed, not thinking about anything in particular, sometimes a pleasurable feeling of *floating*. Often dominant in certain kinds of meditation, alpha waves have for the past twenty years been associated with calm, lucid mental states (the *alpha state*). They are also often detected during dream sleep. Alpha waves oscillate between 9 and 13 times per second.

Theta

Found in states of deep relaxation, theta activity is also associated with bursts of creative insight, twilight (*sleep*) learning and vivid mental imagery. It is also found in more advanced meditators. Theta waves oscillate between 4 and 8 times per second.

Delta

This slowest of brainwave activity, is found during deep dreamless sleep and sometimes in very experienced meditators. They oscillate between 1 and 3 Hz. Human brainwave activity is constantly shifting and changing during the day and night. Virtually every form of mental and physical activity will cause changes in this activity. Abrupt, unexpected noises or other events will quickly alter brainwave patterns. Even watching TV can dramatically alter brainwave activity in an undirected manner. Over the years many mind power techniques have been developed to allow to enter these states, particularly alpha and theta, at will. Most methods, such as meditation, require years of regular practice to achieve these state. Alpha wave biofeedback, quite popular in the 1970s and numbers of people began to look to Biofeedback techniques as shortcuts to entering into deep meditation.

Statement of the Problem

Light-Sound devices (Mind Machines) are among the most exciting fields of research in the world today. For the first time scientists are understanding how to make great improvements in the functioning of any persons mind. Many scientists and cultural analysis now believe such mind enhancing devices may represent a historic break through in human development. Think of

the enormous implications. Tools that will allow large numbers of humans to function consistently at levels of mental efficiency, insight, creativity, and intelligence that have in the past been attained only by the gifted few. Mind machines may be the tools by which the extraordinary becomes familiar. Thomas Budzynski (1976)³ concluded that subjects who could learn to get into a state of synchrony experienced dramatic changes: increases in IQ and grade in school, improvements in performance by executives and athletes. The subjects who learned to produce brain wave synchrony reported extraordinary experiences of highline states of consciousness emotional breakthroughs, feelings of oneness with cosmos and ecstasy. Singh (1987)⁴ conducted a research stimulated by accounts in ancient Tamil literature of peasants using music to stimulate the growth of crops. He played recorded flute like music to balsam plants. An identically matched group of plants, receiving identical amounts of water but no music, acted as a control. Within months the experimentally serenaded plants had 72 per cent more leaves and grew 20 percent taller. The audio programs are offered in varieties designed to promote relaxation, meditation, creativity, etc., as well as to facilitate exploration of expanded states of consciousness (Atwater, 1997)⁵. Brainwave Entrainment was first discovered in 1934, and first experiments used Photic Driving, or entrainment using stimulation from lights. By the 1960s auditory entrainment involving clicks was being used, and photic driving was being used in medical procedures to lessen the amount of anesthesia needed for surgeries and dental work⁶. In 1973, Binaural Beats were invented by Dr. Gerald Oster, whereby two pure sound tones were combined that created a rhythmic beat⁷.

The way it works is that two separate but similar tones are played, one into each ear using headphones. The brain syncs up the difference between the two tones, or carrier frequencies; so if one ear is hearing 400 Hz and the other is hearing 410 Hz, the listener's brainwave patterns move towards 10 Hz (the difference between 400 and 410 Hz is 10 Hz). This would conceivably move the brain into Alpha state^{7,8,9,10}. Binaural beats are an auditory phenomenon that has been suggested to alter physiological and cognitive processes including vigilance and brainwave entrainment. The study examined if binaural beat stimulation altered vigilance or cortical frequencies and if personality traits were involved. Thirty-one subjects were played binaural beat stimuli designed to elicit a response at either the Theta (7 Hz)

or Beta (16 Hz) frequency bands while undertaking a zero-back vigilance task. EEG was recorded from a high-density electrode cap and study suggested a short presentation of steady state binaural beats are not sufficient to alter vigilance or entrain cortical frequencies at the two bands examined and that certain personality traits were not more susceptible than others¹¹.

The Frequency-Following Effect

In the 1940s researcher Gray Walter discovered that brainwave activity tends to mirror flickering light, particularly in the alpha and theta frequencies. This effect has become known as the frequency-following effect. A familiar example is the tendency to slip into a relaxed or dream-like state while gazing into a fire-the flicker rate of which happens to average in the alpha/theta range.

More recently, sound has been shown to produce similar results, particularly pulsed sound and binaural beats. This last effect, binaural, results when one ear hears a pure tone of a slightly differing pitch than the other ear. The brain then actually synthesizes the difference between the two. The portions of the brain associated with hearing tend to fall into step with this pleasant, gently pulsing rhythm. The combination of pulsed light and binaural beat frequencies can be a particularly effective tool for relaxation and preparation for meditation. Pulsed sound in the form of musical rhythms has been entraining people for thousands of years.

Brain electrical activity is largely composed of oscillations at characteristic frequencies. These rhythms are thought to perform important pathological and physiological functions. There are two kinds of sleep characterized as non-rapid eye movement and rapid eye movement sleep and they have different brain wave patterns. Non-rapid eye movement sleep brain waves typically have taller and slower delta waves (1-4 Hz).

Commercially available light-sound machine aid for improving cognitive function. This utilizes sound and light to entrain or synchronize brain waves to alpha, beta, theta and delta neural rhythms. The device uses a series of flashing red lights in conjunction with pulsed tones and background relaxing sounds (river gurgling, birds chirping) to achieve its effect. The lights are presented through an eye goggle device^{12,13,14}.

L-S Instruments

A light- sound (L-S) instrument is a mind entrainment tool. The method by which this entrainment occurs is

Table 16 Instruments for various treatments

Treatment	Instrument
Sound stimulation	Mind Power Music
Light stimulation	Universal Mind Machine (Faster learning model) by Universal Electronics
Light- sound stimulation	Universal Mind Machine (Super IQ model) by Universal Electronics

known as the Frequency Following Response (FFR). Through the use of audio (headphones) and visual (eye frames with LEDs) stimulation, listeners are gently guided into specific states of mind. Each audio beat and light pulse is a specific frequency. Our minds think in terms of frequency. Brainwaves change frequencies based on neural activity within the brain, be it by hearing, touch, smell, vision and/or taste. These senses respond to activity from the environment and transmits that information to the brain via electrical signals. Hearing and vision are considered the favorable senses for affecting brainwaves safely. By presenting these beats and pulses to the brain, within a few minutes, the brain begins to mimic or follow the same frequencies as the stimuli (the beats and pulses). This process is referred to as entrainment¹⁵.

The investigators used commercially available cassette and mind machines for this study (Table 1). These devices were based on sound, light and light-sound stimulations.

Instrument - I

Sound stimulation was given by Dr. Anil Bapna's Mind Power Music cassette. These cassette uses relaxing music based on raga Anil. Raga Anil is the culmination of Indian music. It is defined as nature's music. It means any music that gives you the feeling of being in a park or being in natural surroundings like near a river in the forest or near a seashore etc. is Raga Anil^{16,17}.

Mind power music^{16,17} contains subliminal messages. It means that there are messages, which are hidden from our conscious mind. But, our sub-conscious mind can hear these messages and accept them. Since our conscious mind cannot hear them, it does not interfere with these messages. They simply go to the sub-conscious mind and programs or control the mind to change the behaviour in the desired way. The cassette is of 30 minutes and both the sides are same.

Instrument-II

Light stimulation was given by Universal Mind Machine (Model Faster Learning). The device is

portable. It generates 10 Hz frequency (the scientific term for flashes or cycles per second) flashing light in both closed eyes simultaneously with variable intensity, which can be varied accordingly. The stimulation was given through special eye glasses which consisted by small red light emitting diodes (LED) two per eyes are mounted in a black plastic frames of the folding sunglasses style.

Instrument-III

Light-sound stimulation was given by Universal Mind Machine (Model super IQ). It combines rhythmic light and sound stimulation. The stimulation is given by special cassettes through special eyeglasses with flashing lights in both closed eyes simultaneously with variable intensity and stereophonic headphones. The lights flash in certain pattern and there are certain sound signals containing subliminal messages. As a result, it has the ability to change brain waves to alpha, beta, theta, or delta. This device has been used to explore consciousness, to relax, to enhance intelligence and performance, for learning, for sleep and energy.

Performance Test of Intelligence

All the three treatments i.e. sound, light and light-sound were considered as independent variables of the study. Bhatia's battery of performance test of intelligence was used to analyse the level of intelligence of the subjects.

Bhatia's Battery of Performance Test of Intelligence

To conduct the present study the Bhatia's battery of performance test of intelligence research tool was administered on subjects. Bhatia's battery of performance test of intelligence was constructed by C. M. Bhatia in 1955¹⁸. This test was developed to test the intelligence of Indian population. It includes of five sub-tests namely. Koh's block design test, Alexander pass-along test, Pattern drawing test, Immediate memory test and Picture construction test.

(i) Koh's Block Design Test

This battery includes 10 designs from the original 17 designs from the Koh's test. The time for first five designs is 2 minutes and for the remaining five the time is 3 minutes. The cards with a variety of coloured designs are shown to the test taker and he/she is asked to reproduce them using a set of coloured blocks. Performance is based not just on the accuracy of the drawings but also on the examiner's observation of

behaviour during the test, including such factors as attention level, self-criticism and adaptive behaviour (such as self-help, communication, and social skills).

(ii) Alexander Pass-along Test

All the designs of the original test are included in this battery and consist of certain blocks of red and blue colour. The subject has to arrange the blocks according to the card shown to him/her. The first four of these have to be completed in two minutes and the rest of the four have to be completed in 3 minutes.

(iii) Pattern Drawing Test

This test is constructed by Bhatia. There are eight patterns of increasing difficulty from first to eighth. In this the subject has to make the figures as shown in the card without repeating on lines and without lifting the pencil. The time for the first four cards in 2 minutes and for the rest of the four cards it is 3 minutes.

(iv) Immediate Memory Test

Immediate memory has a close relation with mental development or general intelligence. It starts with two letters and then increases accordingly. Firstly the investigator speaks out the word and then the subject. There are three alternative sets of letters. If failure is recorded in the first set, try the second and the third alternative sets. If failure is recorded in all the three alternatives the failure is recorded and we stop. The same steps are to be followed in reversed sounds.

(v) Picture Construction Test

This is a comparatively easy test. It has been purposely put into enable some of the inferior children to score appreciably. The test consists of five graded sub-tests. In these sub-tests there are number of pieces and the subjects have to put the pieces together to form the picture. The time for first two pictures is 2 minutes and the rest of the three pictures it is 3 minutes. Individual administration of this test takes less than one hour. Maximum 95 marks can be obtained in the complete test. Maximum marks for the 1st, 2nd, 3rd, 4th, and 5th test are 25, 20, 20, 15, 15 respectively.

Sample and its Selection

A sample of 120 students were selected from teenage group i.e. 13 to 19 years of both sex belonging to middle socio-economic status by purposive random sampling technique from Udaipur and Jhunjhunu district of Rajasthan State. Out of which 90 subjects were selected

as experimental group and remaining 30 were kept in controlled group.

The experimental condition was further divided into three experimental groups and were administered three different treatments of mind power techniques i.e. sound, light and light-sound through mind power music and mind machines¹⁹. The sample was also divided on the basis of Gender i.e. male and female and further by having early teenage (13-15 years) and later teenage (16-19 years) group of respondents to see the difference of mind power techniques among these group of respondents.

Procedure

The data for present research was collected in different stages. A pilot study was conducted with 20 samples prior to the main data collection. For each treatment 5 samples were selected and given each treatment i.e. sound, light and light-sound. Pre test, post test design was used by giving interventions of three type of experimental conditions. Each group was administered a group of pre test. In the experimental group each of the subject were given their treatment as selected by investigator and were instructed to use it for six days a week for 7 weeks (42 treatments). Under the guidance of the experimenter. After 42 days post testing was done immediately after the sound, light and light-sound treatment to the respondents for the variable under study i.e. Intelligence.

Result and Discussion

The scoring was done as per the procedure laid down in the manual of the test. The difference of pre and post scores were then computed and analysed with suitable statistics, mainly the Mean, Standard deviation, t -value and F-Ratio were applied to find out the significance of difference among the gender, stages of teenage and experimental and control group. All the three treatments i.e. sound, light and light sound were considered as independent variables. The data for the present research work has been collected from 120 teenagers of Rajasthan state, to study the effect of three independent variables on Intelligence dependent variables of the research investigation. The Mean, Standard deviation and t -values were calculated for each dependent variable and difference between male and female, early and later teenagers and pre and post scores. To see the difference between independent variables viz.: sound, light and sound-light stimulation ϕ , analysis of variance was done. The results of various parameters were as follows:

Table 26 Showing Mean, Standard deviation and t -value for Intelligence

Testing Stage	Pre test		Post test		t -value	
Gender ϕ	Male	Female	Male	Female	t -value	
Mean	93.1	91.9	109.4	107.9	0.66	
S.D.	8.7	7.3	6.7	5.7		
t -value	41.4	49.0	63.3	73.6		
Stages of Teenagers ϕ	Early Teenagers		Later Teenagers		t -value	
Mean	91.8	93.3	108.6	108.7	0.05	
S.D.	6.6	9.1	5.9	6.5		
t -value	53.6	39.4	70.8	64.3		

Table 36 Mean, SD and t -value of pre test and post test scores for Intelligence

Treatments	Pre test		Post test		t -value	Gain (%)
	Mean	S.D.	Mean	S.D.		
Super I.Q.	94.20	12.73	113.03	10.99	6.13**	22.59
Faster Learning	89.40	6.31	107.50	6.19	11.21**	20.25
Music	94.01	12.40	105.30	12.12	3.58**	11.94
Control	89.63	8.24	89.13	8.48	0.23	-
SEm	1.88		1.78			
C.D. 5%	NS		4.99			

** Significant at 0.01 level

Table 2 reflects that there was no difference between male and female and early and later teenagers in pre and post scores of intelligence. Results reveals that mean square of pretest and post test scores are 213.49 and 3162.92 (significant at 0.01 level) and degree of freedom is 3. Error (with in) pretest and post test are 105.88 and 94.53 and degree of freedom is 116. Therefore an analysis of variance reveals significant difference between different treatments for post test scores of Intelligence.

The maximum score (Table 3) was observed for Super IQ followed by Faster Learning and Music. The difference between Faster Learning and Music was non-significant. However the post test score of all the three treatments were significantly higher than the post test score of Control group. At pre testing stage the score of all the respondents selected for different treatments was at par. This table also summaries that there is significant gain in these three treatments i.e. 22.59, 20.25 and 11.94 percent in Super IQ, Faster Learning and Music respectively. There was no gain in control group (Fig. 1). The results reveal that both sexes and both stages have no significant difference in relation to Intelligence at pre testing and post testing stage. This may be due to the education system and equal opportunities given to both sexes i.e. boys and girls. Now the females are also exposed to the environment equally as the boys. Further as far as the cognitive aspect of behaviour is concerned

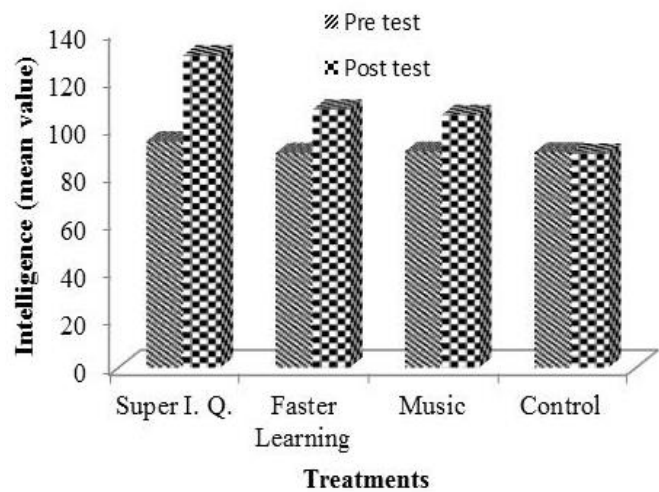


Fig. 16 Effect of different stimulation methods on intelligence

the sex doesn't import the difference because it is the potential of the subject which matters in the human behaviour. The way in which the brain actually develops enables us to dispose of the question of whether Intelligence is a function of heredity (nature) or environment (nurture). The answer is both: the number of brain cells is a factor, but the way those brain cells are stimulated to make rich connections is far more significant. Thus it is probably correct to say that almost every normal child is born a potential genius. Even of innate intelligence is merely average, a rich intellectual environment during the period of the second brain growth

spurt, with plenty of opportunities to learn, can ensure the development of a growth proportion of the brain potential than would normally be expected. As the three different experimental stimulation i.e. sound, light and light-sound were given, in result there was increase in the post test scores. The positive increase was the result of stimulation given to them because the stimulation given to the respondents effect the brain waves and stimulation given to the them makes both hemispheres of the brain to become coherent.

The results were in agreement with the findings of EEG biofeedback studies. Thomas Budzynski (1976, 1992)^{3,20} found that subjects given light and sound stimulation experienced positive dramatic changes in IQ and grade at school level. From Table 3 and Fig. 1 it is clear that there was a positive gain in intelligence of the subjects. Tansey (1984, 1990)²¹⁻²² has also reported significant IQ gains after EEG training and Cunningham (1981)²³ obtained similar kind of improvement in reading and increased self control after EEG bio feed back training other studies of subjects. Suffering from cognitive deficits caused by brain damage showed that CES treatment not only improved cognitive functioning but also in fact reversed the brain damage that caused the cognitive deficits in the first place.

Conclusions

The scores of Intelligence showed a significant difference between the entire experimental groups and control group. The maximum score was observed for Super IQ followed by Faster Learning and Music. There was no difference between both genders and both stages of teenage at pre testing and post testing stages but after giving interventions, gain was noted for Intelligence. On the basis of these conclusions it has become clear that mind power techniques are very effective to stimulate the cognitive aspects of an individual. These techniques could be very much effective for the teenagers to achieve their goals in the life because today is the world of competition and every individual wants to for higher profiles. So this path of Light-Sound stimulation seems to be the best for the teenagers.

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