THE EFFECTS OF AUDITORY STIMULATION AND MOVEMENT ON PERFORMANCE FOR THE ATTENTION DEFICIT DISORDERED STUDENT

A Thesis

by

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July 1985

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ABSTRACT

THE EFFECTS OF AUDITORY STIMULATION AND MOVEMENT
ON PERFORMANCE FOR THE ATTENTION DEFICIT
DISORDERED STUDENT. (July 1985)

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The present study was designed to investigate the effects of auditory stimulation and movement on the recognition of material presented visually for the Attention Deficit Disordered student. The subjects consisted of 11 boys and 2 girls between the ages of 11 and 13 who were previously diagnosed as Attention Deficit Disordered. Twelve CVC syllables were visually presented with a Caramate projector under three auditory conditions: no auditory stimulation, music, and semantic distractor. Recognition was assessed by having the subjects circle the previously presented syllables on a printed list of 42 syllables. The number of correct responses was recorded. The subjects were observed while seated in an office chair positioned for conditions of rocking or

nonrocking. The chair also allowed for swaying under both seat conditions. Random movements and swaying were calculated by a 10-second time sampling procedure in the learning and recall phases of the experiment. Additional random movements were rated on a four-point scale and recorded by a 10-second time sampling procedure during both phases of the experiment. The hypothesis that the level of success would be greater for those subjects who incorporated music into their learning was not upheld. Further, the level of activity did not decrease with auditory stimulation.

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INTRODUCTION

A recent review of the research (Weiner, 1982) indicated that 5% to 6% of school age children display a syndrome comprised of developmentally inappropriate inattention, impulsivity, and hyperactivity. The Diagnostic and Statistical Manual of Mental Disorders (DSM III) (APA, 1980), has applied the label Attention Deficit Disorder (ADD) to this syndrome. ADD affects 2.5 million 5 to 14 year old children in the United States and 1 child in every 20 children in the classroom. Boys are diagnosed as having ADD 10 times more often than girls with the onset typically by the age of three. DSM III lists two categories of ADD, those with hyperactivity and those without hyperactivity. The ADD child without hyperactivity does not have unusual difficulty remaining still, but, he/she is likely to have trouble completing assignments and organizing or planning activities. Problems related to ADD are more likely to be displayed in situations that require self-application, such as the classroom, and they may not be observed when the child is in a novel or one-on-one situation.

Weiner (1982) suggested that because the ADD characteristics of distractability, short attention span, and limited ability to concentrate, are incompatible with academic performance, the child is likely to manifest a learning disability (LD) during the school-age years. Weiner also suggested that some writers, in fact, use learning disability interchangeably with Attention Deficit Disorder when talking about the school-age child who is achieving below expectations in school in the absence of any general intellectual deficit, emotional handicap, or inadequate opportunity to learn. ADD was first introduced by DSM III in 1980. Research using this term is, therefore, limited. Children previously categorized as hyperactive or LD, however, have similar characteristics to those more recently characterized as ADD children with hyperactivity.

Kendall and Braswell (1985) reviewed the recent literature regarding hyperactivity and academic success. They cited research which presented evidence that while overactivity generally decreases between the ages of 12 and 16, many of the associated problems persist. Research indicated that hyperactive children were distinguishable from normal controls in terms of fewer completed years of education, lower academic standing, and more failed grades. The relationship between hyperactive behavior and that of the LD child is apparent in light of consistent findings of academic underachievement. It is necessary to caution, however, that hyperactivity does not necessarily imply ADD in all cases.

Because young people spend so much of their time in school during the middle childhood and adolescent years, educational planning plays a critical role in the treatment of learning disabled children who show signs of ADD. Opinion appears to be divided, however, as to whether they should learn in a distraction-free or in a stimulating environment (Weiner, 1982). With the recent emphasis on mainstreaming, it would seem critical to determine what kind of an ambient stimulation is most conducive to learning for the ADD child.

Although the concept of ADD had not been developed, early theorists studied children with characteristics similar to ADD with hyperactivity. Cruickshank, Benzen, Ratzeburg, and Tannhauser (1961), designed specially engineered classrooms to eliminate perceptual contrasts and reduce visual and auditory stimulation for hyperactive children. They found that hyperactive children showed more academic progress in this setting. Carter and Diaz (1971), Rugel, Cheatam, and Mitchell (1978), and Zentall (1980) argued that the setting of reduced stimulation deprived children of the opportunity to learn to handle distracting stimulation in the real world. The research of all three authors suggested that hyperactive and learning disabled children were less restless and achieve better in learning situations that include ordinary school background sights and sounds than situations where meaningful external stimulation had been reduced.

The ADD child with hyperactivity seems to be equivalent to syndromes also described by other terms such as Minimal Brain Dysfunction and Hyperkinesis. One recommended method of treatment for these children (Reid, 1983) has been to administer stimulant drugs such as Dextroamphetamine (Dexedrine) and Methylphenidate (Ritalin) which seem to have a calming effect and increase the child's ability to maintain internal thought processes in spite of external distraction. These drugs apparently bring an underaroused nervous system in these children up to a normal optimal level and facilitate the control of motor and sensory functions. Weiner (1983) suggested, however, based on his research review, that stimulant drugs alone have no beneficial impact on learning difficulties or other secondary consequences of attention deficit disorders.

The notion that ADD children with hyperactivity have an underaroused nervous system is supported by proponents of optimal stimulation theory. Zentall (1975) suggested that hyperactivity may result from a homeostatic mechanism that functions to increase stimulation for the child experiencing insufficient sensory stimulation. He goes on to suggest that hyperactive behavior serves a functional value for the child to optimize endogenous stimulation rather than be a consequence of too much stimulation. If this is correct, tasks low in stimulation should result in more hyperactive behavior than those higher in external stimulation. Pope (1970) conducted research which supported the optimal stimulation theory. He found the most difficult task for hyperactives to be that of waiting without movement while sitting in a chair which involved virtually no task stimulation.

If one is to assume that stimulant drugs increase the hyperactive child's level of arousal, thereby increasing his/her receptiveness to stimuli, then environmental stimulation such as auditory stimulation and rocking may be sufficient to reduce hyperactive behavior and improve the environment for learning. The ADD child may require a simple alteration of his/her environment to include a neurological arouser in order to produce conditions most conducive for attending and learning. This is in contrast to other notions that propose reduced ambient stimulation improves the learning environment for the ADD child.

Effects of Noise on Learning

Research on the effects of background noise on learning has produced results antitheoretical in interpretations. Poulton (1977) theorized that loud noise may impair short-term memory performance by masking the internal verbal rehearsal necessary to maintain information in short-term storage.

Millar (1979) examined Poulton's theory. His subjects consisted of 20 adults ranging in age between 19 and 33. The noise condition consisted of a 92 dBA broadband noise presented during the learning and recall phase of the experiment via a loud speaker. The quiet condition consisted of the same noise heard at 75 dBA. Performance was assessed over the last two days of a three-day examination period. A repetitive, visual consonant recall task was employed in which eight consonants were visually presented and the subjects wrote down as many letters as possible from memory. Performance over the last two days indicated that total recall was better overall in quiet (75 dB) than in noisy (92dB) conditions, however, on the last day of the experiment recall in noise improved and was superior to that of the quiet group. Quiet group recall declined over the last session. Millar concluded that it was difficult to relate recall of serial order information to noise-masking alone, but, such performance may be consistent with the attentional influence of noise which arises from a physiological arousing property of noise. It is important to note these subjects and the subjects in the other studies cited in this section were of average learning ability and no comparative study with LD subjects was made.

Wilding and Mohindra (1980) suggested noise improved performance by increasing the need for and use of subvocal articulation. A series of four experiments described in their article studied the effects of subvocalizing and noise on recall. The subjects were 20 college students who were shown a visual presentation of several series of five letters under noise conditions described as a hissing sound at either 65 or 85 dBC. The noise condition was presented during the learning phase of the experiments. Confusable and nonconfusable lists of letters were examined as well as articulatory suppression, recall delay, and rate of presentation. A significant effect related to noise was that noise at 85 dBD compared with 65 dBC improved performance on confusable lists. A further experiment was conducted to test whether articulating aloud had the same effect as noise. Articulating aloud was described as reading the letters aloud as they were visually presented. All other details of experiment #1 were replicated using different subjects. The improvement in recall under higher noise levels was also found with nonconfusable as well as confusable lists. Experiments #3 and #4 tested various aspects of the first two. All four experiments supported the view that noise improved recall of order. Suppression of internal subvocal rehearsal produced by having the subjects say "the" continuously during list presentation depressed performance.

Fowler and Wilding (1979) examined the effects of two arousers on learning tasks. Three experiments were conducted with 32 university students in each to examine the effects of monetary incentives and noise on learning. The task consisted of a visual presentation of color coded nonsense syllables. The subjects were asked to learn the word and corresponding color. In the first experiment monetary incentives improved learning of nonsense words and their corresponding colors as compared to the control group. Monetary incentives were then examined in an exercise that required the recall of spatial locations. The subjects were asked to recall the location of the eight previously administered nonsense words presented visually. Monetary incentives were examined in the learning and recall phases. It was determined monetary incentives improved recall of spatial locations when presented during learning. The third experiment replicated the second one except three levels of noise (60, 80, and 100 dB) were used as the arouser instead of monetary incentives. The results showed a significant decrease in correct responses as the noise level increased. Interestingly, the performance in the 60 dB condition which was the approximate mean level of background noise in the room and equivalent to the control condition in the previous experiment, was considerably better than the control condition of the previous experiment. This suggests low level noise may help to reduce distractions and improve recall. The results of these experiments suggest that the arousal effects of noise and incentives cannot be directly equated because loud noise, but not soft noise, appears to reduce attentional capacity while incentives appear to increase it.

Research seems to indicate that low level noise may serve as an arouser and improve performance for some normal learners. However, noise at higher levels appears to be distracting and hinder learning. Conflicting results suggest perhaps it is the intensity of the noise that must be questioned in order to assess its influence on learning.

Effects of Music on Learning

Several studies have been conducted to determine whether music had similar effects on learning as background noise. Research indicated that music may actually aid in enabling students to attend to relevant stimuli. Stainback, Stainback, and Hallahan (1973) investigated the effects of calming background music on task relevant and task irrelevant learning of 64 educable mentally retarded students. The subjects were divided by age into two equal groups consisting of ages 10-12 and 12-14. For this experiment the relevant task consisted of six

3" by 6" cards with a drawing of a household object and a drawing of an animal that were consistently paired on each card. The irrelevant task consisted of six 3" by 3" cards each displaying a picture of the household objects discussed above and an 8" by 22" card with each of the six animal pictures displayed on the bottom half. Besides the calming music (Bach's Air for the G String), typical school hall noises were played in the background for one experimental situation and a combination of music and hall noise for the third variable. Specific learning tasks were not further described. Results indicated that the performance in the music was significantly superior to the nonmusic for the task relevant condition, but not for the task irrelevant condition. It was concluded that music may facilitate attention to relevant visual stimuli and it does not appear to interfere with the ability to process extraneous visual stimuli.

Wakshlag, Reitz, and Zillman (1982) examined the effects of appeal and tempo of background music on attention and information acquisition of 50 normal first and second graders. Music was rated prior to the experiment by 10 students to determine appeal and was dubbed into the background of an educational T.V. segment. The background music was either fast and appealing, fast and unappealing, slow and appealing, or slow and unappealing. It was found that music of slow tempo had a negligible effect on attention and information acquisition. Rhythmic fast tempo background music, especially when appealing, significantly reduced visual attention and impaired information acquisition.

Scott (1970) examined the effect of popular background music on learning with four hyperactive boys residing in a residential home for children. His selections of music included the then currently popular "Sgt. Pepper's Lonely Hearts Club Band" and "Magical Mystery Tour." Performance on a written arithmetic exercise was the dependent variable. Normal classroom noise and background music played at a normal listening level were presented in two classroom conditions: one where the child sat at a normal classroom desk, the other where he sat at a desk surrounded with a three sided booth. Three of the four children functioned at their best under regular classroom conditions with music playing in the background. All children performed better in the booth with music playing than in the classroom setting with normal noise. Scott suggested that hyperactivity may be reduced by lowering or altering stimulus levels.

Research has recently been conducted on the Lozanov Method and suggestive-accelerated learning techniques which claimed to increase learning ability (Pritchard & Taylor, 1976, 1978). The purpose of this technique was said to be to integrate the conscious with the unconscious in order to promote relaxation on the one hand, and concentration of attention on the other. According to this method, new information is introduced several ways. The student is first asked to engage in an active response of playing games using basic phonic skills. New vocabulary is introduced combining contextual and kinesthetic methods. The student then acts out a play comprised of the new vocabulary words. The passive stage is introduced which consists of having the student lie down, close his eyes, and breathe to the beat of a metronome. Visualization exercises are subsequently employed using alternating themes for three five-minute sessions. Further suggestions emphasizing positive self-worth are also given. The teacher then auditorily presents previously introduced vocabulary words to the beat of the Baroque music played in the background while the children's breathing is coordinated with the beat. After the students return to a normal waking state the teacher rereads the vocabulary list. A shortened version of this session is then presented the second day.

Prichard and Taylor (1978) instructed 40 remedial reading students, ages 8-13, with methodology employing two basic elements of the Lozanov system. This consisted of presenting lesson material in both attentive and nonattentive states, and attempting to create a relaxed, nondefensive atmosphere in which both external and internal distractions were minimized. The instruction consisted of two 45-minute class sessions on the same material from each reading lesson for a period of 16 weeks. Each session contained both active and passive instructional activities. Following Lozanov pattern Baroque background music was played while vocabulary material was introduced auditorily during the passive stage. When this technique was used for remedial reading instruction with LD and educably mentally retarded students an increase in reading ability was noted. It is difficult to determine, however, what variable or combination of variables produced the desired effect since research on this technique is only in its infancy in this country. There was also no control group or comparative method used to look at average knowledge gained with a conventional method of instruction.

Proponents of silva mind control techniques have claimed an increase in performance. This technique uses relaxation and music similar to the Lozanov method. Kline (1976) investigated the use of relaxation techniques in education. The subjects were 20 9th-12th graders who were unsuccessful in the traditional school. It was his belief that the best way to approach learning was on four different levels of the physical, emotional, intellectual, and spiritual self. He accomplished this, in part, by using silva mind control techniques to gain controlled mental relaxation. In this relaxed state the students had the text read to them while listening to music. In spite of the students' reported lack of motivation and past record of poor achievement, they learned 500 Latin words in a five week period. Kline theorized the use of classical music appeared to divert the mind from the subject matter presented and thus allow it to be more receptive on the unconscious level. It is important to note there was no comparison group for this study and the stimuli were presented auditorily. It is also unclear what effect relaxation or the combination of relaxation and music had on performance.

In conclusion, background music could be advantageous to learning. This appears to be the case when the material is introduced either auditorily or visually. In the studies cited where the material was introduced auditorily, there were additional variables such as relaxation. Sufficiently attractive music may have the effect of creating increased attention by increasing the levels of alertness, or it could have the opposite effect of enhancing a relaxed state. The comparatively inattentive student may be attracted to the music stimuli, and once attracted, his/her increased alertness could extend to visual learning activities that would otherwise be processed under conditions of lower alertness or arousal. Care would need to be taken in the selection of the music so as to avoid the possibility of it also becoming a distractor to the student.

Studies Comparing Various Auditory Distractors on Learning

A review of the literature on the auditory attention abilities of children with a learning disability or hyperactivity has generally indicated that these children have more difficulty with selective auditory attention than their normal counterparts (Lasky & Tobin, 1973; Woodcock, 1976). In a study by Cherry and Kruger (1983), selective auditory attention skills of LD children were compared with the performance of normal achievers, ages seven through nine. The task consisted of pointing to pictures which represented words that were presented to them auditorily moments before. The task was administered under three distracting conditions: white noise (distractor), speech backwards (linguistic nonsemantic), and speech forward (semantic). The speech backwards consisted of an interesting story played backwards to remove meaning. The results indicated the performance of the LD child was more adversely affected than the performance of normal achievers under all conditions. The greatest difference was found with the speech forward distractor. This finding is consistent with optimal stimulation theory (Zentall, 1975) which considers the meaningful speech forward to produce the greatest stimulation. The stimulation in this case surpasses the optimal level for learning and causes a decrease in successful responses. This study also indicated that selective auditory attention skills improve with age. This is consistent with a theory which states the LD child possesses a developmental lag in selective attention abilities (Tarver, Hallahan, Cohen, & Kauffman, 1977). The finding that selective auditory attention improves with age is consistent with an earlier study by Hendrick and Kunze (1974) who found significantly fewer errors produced by progressively older normal children in grade levels of preschool through first grade when presented with competing auditory messages. Macoby and Konrad (1966) also found the skill of selective listening to increase in normal children with age along the grades kindergarten through four continuum.

A study by Nober and Nober (1975) looked at the effects of classroom noise on the auditory processing abilities of normal and LD children. Forty children within the age range of 9-0 through 11-8 were divided into normal and LD groups. The learning disabled group met the specific criteria for learning disability placement by the Department of Education. Each subject was administered Form I and Form II of the Wepman Auditory Discrimination Test in a single 20-minute session. One form was presented auditorily in the quiet listening condition, the second with a tape recorded classroom noise at 65 dB at ear level. Results indicated LD children made significantly more auditory discrimination errors than normal children in quiet and noise conditions. Both normal and LD children made significantly more auditory discrimination errors in noise than in quiet.

Tarver et al. (1977) explained the difference in selective attention and language abilities between learning disabled and normal children by means of a developmental lag hypotheses. In their research they refer to selective attention as the ability to visually attend to relevant environmental stimuli and ignore irrelevant stimuli. Their subjects consisted of 14 learning disabled boys with a mean mental age of 15. The task consisted of presentation of seven stimulus cards with an animal pictured on the bottom half and an object pictured on the top half. Subjects were instructed to attend to the animals only, and the card was placed face down. A card was then presented with one of the animals and the subjects were asked to turn over the identical card. The incidental recall phase consisted of presenting the subjects immediately after the central recall phase with a card depicting the seven animals and asked to match cards with the seven objects. Their scores from an incidental recall test were anlayzed in combination with those of 8-, 10-, and 13-year-old LD boys from an earlier replicated study. Their results provide strong support for the hypotheses of a developmental lag in selective visual attention in LD children. They further suggested that a lag in verbal rehearsal strategies underlies the lag in selective attention.

It has thus been shown that LD children have more difficulty than normal children with selective auditory attention and selective visual attention. Distracting auditory noises tend to interfere with auditory attention and discrimination. Distracting visual cues, likewise, interfere with visual attention. There is no indication, however, that increasing the auditory stimulation impedes selective visual attention. It is, therefore, suggested that an increase in auditory stimulation may improve performance on a visual learning task by increasing the level of arousal, yet, not interfering with the task.

Relationship Between Hyperactivity, External Stimuli, and Learning

According to Zentall (1975), a child is labeled hyperactive when he/she is judged to exhibit specific behaviors to a greater extent than normal children. These behaviors typically consist of increased activity, short attention span, distractibility, impulsiveness, explosiveness, inability to delay gratification, and poor school performance. Hyperactivity is a social judgment based on the frequency and intensity of these behaviors displayed at inappropriate times.

Zentall (1975) reviewed the research related to hyperactivity and presented evidence in support of the theory of optimal stimulation. This theory suggested that hyperactivity is an attempt to increase insufficient stimulation rather than being a consequence of overwhelming stimulation. Activity is seen as a regulator which maintains optimal stimulation for the child. Therefore, if the external stimulation is low, the activity level of the child increases; when the stimulation is high, activity decreases. It goes on to say that an individual will work to maintain an optimal level of stimulation whether that stimulation is self-generated, as in hyperactivity, or provided by an external source as in drug or behavior therapy or by manipulated increases in environmental stimulation.

This theory was supported by four experiments by Rugel et al. (1978) who tested various aspects of an optimal level of arousal model of hyperactivity in LD children. The first experiment consisted of a sample of 38 LD children and 24 control subjects with an age range between 7 and 12. The task was a vigilance task which consisted of listening to a series of numbers and responding by pressing an event marker when the number six was heard. The results indicated that the vigilance performance of LD students was poorer than that of control subjects throughout the task. Experiment II was based on the hypothesis that levels of body movement would increase throughout the vigilance task and LD students would show quicker and greater body movement. This was based on the premise that greater inattention resulted in greater underarousal and, therefore, in greater levels of body movement. Both of these hypotheses were upheld. In experiment III the level of body movement occurring under different levels of stimulation was investigated in 30 normal elementary school students. Results showed the greater the signal frequency in the vigilance task, the smaller the amount of body movement. Experiment IV compared the performance of LD and normal children under high and low rates of signal frequency. Findings indicated that high signal frequency conditions resulted in lower levels of body movement. LD students did show greater body movement levels but in the absence of an attentional deficit.

Behavior therapy techniques appear to be effective means of reducing hyperactive behavior (Kendall & Braswell, 1985). Behavior therapy involves the systematic use of behavioral consequences to change behavior (Kazdin, 1980). Numerous studies were cited by Kendall and Braswell to substantiate the use of behavioral techniques with hyperactive children. According to their review, hyperactive children appear to be particularly dependent upon a high rate of reinforcement compared to normals and revert rapidly when reinforcement is withdrawn. Thus, for hyperactive children, the reinforcement of appropriate behavior appears to be effective in increasing the probability of those behaviors only as long as the behavior continues to be reinforced. Kendall and Braswell advocate the use of cognitive behavioral therapy with the hyperactive child to maintain the behavioral change in the absence of direct reinforcement through the use of other behavioral techniques. The child is taught to control his/her own behavior through self-verbalizations and thus be less dependent on high rates of external reinforcement. It appears that behavioral therapy can be an effective means of reducing hyperactive behavior not only through the selective strengthening of behaviors, but, also because it serves to increase environmental stimulation. If reinforcement produces stimulation, the fact that intermittent reinforcement is not very effective in reducing hyperactive behavior is consistent with the notion that the hyperactive child requires more stimulation than the normal child to maintain the same level of performance.

Hunter, Johnson, and Keefe (1972) examined the differences between readers and nonreaders with respect to physiological orienting response patterns in the autonomic nervous system. Twenty male nonreaders ranging in age between 7 and 11 were compared with 20 matched controls. Results indicated a significantly lower attentional or arousal level of the disabled reader as reflected in lower basal skin conductance level over trials. This study also pointed to a deficit in speed of motor response for the disabled reader.

Hamilton, Hockey, and Quinn (1972) investigated the effects of noise-induced arousal on immediate recall of visually presented paired-associate learning. The 100 adult subjects were presented a paired-associated learning task at two sound pressure levels; quiet and noise. The noise was produced by a sound generator and projected at 55 dB for the quiet condition and 85 dB for the noise condition. It was assumed that manipulation of noise levels would create different levels of arousal. The interaction between the noise condition and recall suggested that more information was stored in the noise condition.

In summary, it has been shown the ADD child's developmental and educational progress is impaired by frenzied, directionless behavior. He/she is unable to engage in the systematic exploration of novel stimuli and the patient repetition of motor acts which are indispensable to learning. Additionally, this student has more difficulty learning than his/her normal counterpart because he/she is easily distracted by loud noises or meaningful noises such as a story heard in the background. Efforts to control hyperactivity and attention have understandably been central in the work of special educators. Their attempts have consisted of the use of drugs and have included most notably the techniques of behavioral therapy and the control of stimulus levels in the learning environment. It is the latter approach which is of particular interest in the present study.

Statement of the Problem

According to the optimal stimulation theory, hyperactivity has been shown to decrease when the external stimulation increases (Zentall, 1975). If true, it seems that the optimal learning environment for the hyperactive student is one of increased external stimulation but not to the intensity where the stimulus would become a distractor. It further appears that an auditory stimulus can be used to increase the arousal level without interfering in a visual learning task. The purpose of this study was to investigate the effects of soft background music on learning and level of activity in ADD students. It is assumed that music is an auditory stimulus that will create an increased arousal state and reduce hyperactivity. It is further assumed that a semantic distractor would increase the arousal state, but, to the point where the attention to available cues would diminish and eventually produce a deterioration of task performance. In this study movement is considered to be a method of self-stimulation that would increase the arousal level.

Hypotheses

The level of success on a visual learning task will be significantly greater for ADD students in the presence of music than for those who perform the task in the presence of no auditory stimulation or with a semantic distractor.

There will be a higher level of success on the visual tasks performed under the environmental stimulation conditions of no auditory stimulation, music, and semantic distractor when the student is seated in a rocking chair and permitted to rock than comparable tasks when the student is seated in a stationary chair and rocking movement is restricted.

The rate of movement will be greatest during the task presented in the no auditory stimulation environment.

Generally, students who have the opportunity to rock will do better than the nonrockers if they are not engaged in compensatory psychomotor movement.

The main effect of the auditory distraction will show the greatest decrement of performance under the semantic distractor condition.

The level of success and the level of movement will be least during the presentation with the semantic distractor.

METHOD

Subjects

The subjects were 11 boys and 2 girls between the ages of 11 and 13 who were selected from a population of students attending a private tutoring program at The Learning Center of Catawba County, Inc. Intelligence was average or above average as measured by the Wechsler Intelligence Scale for Children-Revised (WISC-R) and they were previously diagnosed as ADD by a licensed psychologist. Each subject's achievement scores as measured by the Peabody Individual Achievement Test (PIAT) were at least one year behind expected grade achievement. There were no reports by teachers or parents of emotional problems and students were not presently taking medication to control hyperactivity. Written parental permission was obtained prior to the experiment.

Materials

Consonant-vowel-consonant (CVC) syllables were individually printed on a 6" by 8" white card using 2" stick-on letters. Each CVC card was photographed to make a black and white slide. Twelve different slides were used for each list presentation. Six additional lists were typed on a 6" by 8" sheet of white paper which consisted of the original 12 CVC syllables and 30 additional CVC syllables. This list was made in order to assess recognition of the syllables that were recalled. The lists were stapled together in the order of presentation to make a booklet. Except for the original items no CVC syllables were repeated on any list. The CVC syllables were selected randomly from a list with association values between 25% and 50% (Stevens, 1951).

A Singer Caramate projector model number 3300 was used for presentation of the CVC syllables. Three audio tapes were used to program a three-second presentation duration for each CVC syllable and present three auditory background conditions. There was no time between presentations of the syllables. One tape contained a background recording of a slow (4/4 time) Baroque etude produced by Superlearning, Inc. which they described as an aid in learning. The second tape contained the semantic distractor which consisted of a female voice reading from Rikki-Tikki-Tavi, by Rudyard Kipling. The third tape contained no recorded sounds.

The volume of the auditory stimulation was determined by a sample of three LD boys who did not participate in this study. They were asked to adjust the music used for this research played through headphones to a comfortable level while reading. The mean volume of 50 dBs was used as the setting for the three tapes used throughout the research. The auditory stimulation was presented through headphones at a constant volume.

Three identical office chairs were used for the rocking and no rocking conditions. The chairs were equally adjusted and easy for a child to rock in. In the stationary position, the chairs allowed for a swaying, but not a rocking movement. A data sheet was prepared to record the number of rocks and sways during the learning and recognition phases of the experiment. Sways were described as a sideways swivel movement of the seat of the chair. Four 10-second samples were recorded during the learning phase and four during the recognition phase for each student. The intensity of the random movements was rated on a four-point scale during four 10-second periods in both the learning phase and the recognition phase for each student.

Procedure

The 13 subjects were tested by the author during the month of August, 1984. All subjects arrived at the Center at 10:00 a.m. They were instructed to eat nothing for an hour prior to coming, and were only permitted to drink unsweetened "Koolaid" during their break. The subjects were tested in three groups of three and two groups of two. Upon arrival they were told: Thank you for agreeing to help us. Today we are going to try some different ways of learning. I think you will find it fun and it should take about an hour. Please follow me so we can get started.

The subjects were then escorted to a 10 by 10 foot examination room which was free of other staff and clients. Each subject was seated in front of a table with a Caramate visual projector located approximately three feet in front of them. All subjects were seated either in a chair adjusted for rocking or adjusted for nonrocking.

The task was first taught to the subjects by the examiner who read the following instructions: I want you to wear these headphones while you are working. Sometimes you may hear voices or music and sometimes you may not. On the screen in front of you you will see nonsense words consisting of three letters each. When you see the word, I want you to study it, then I want you to circle the words you just saw on this sheet of paper I will give you. When you have finished, take the headphones off. Let's practice first so you can understand what I am talking about. Relax, put the headphones on, and begin when you see the first word.

A list of three CVC syllables was shown on the screen for the practice session. There was no background auditory stimulus included on the tape. The CVC syllables were presented one time immediately subsequent to which the subjects were presented a pencil and sheet of paper attached to a clipboard with 10 CVC syllables typed on it. Upon completion of the practice session, the answer papers were collected. The subjects were not given feedback on their responses.

Subsequent to the practice session the answer booklet that was attached to a clipboard, and a pencil was presented to the subject. The cover was arranged so the subject could not see the printed CVC syllables. The top page was turned over by the examiner immediately following each list presentation for each subject.

One series of 12 CVC syllables was presented under each of the three auditory stimuli with a five-minute pause between recall and subsequent list presentation. There was a 15-minute break between the first three and last three list presentations at which time the chairs were adjusted for the remaining condition. The subjects were not in the examination room at this time. The CVC lists, auditory stimulation, and rocking conditions were all counter balanced between subjects. All subjects in one group were either in a rocking or no rocking condition at one time. Tape recordings of music and semantic distractor began prior to the presentation of the first CVC syllable and continued uninterrupted until 12 were presented and the subject identified the responses on the response answer sheet.

Prior to the start of each session the subjects were read the following instructions: Now we are ready to begin. This time you will see 12 nonsense words. After the words stop, circle only the 12 words you have just learned on the sheet of paper. You will have plenty of time to do this so take your time. When you have finished, take your headphones off. Put your headphones on and begin when you see the first nonsense word.

The following instructions were read before the presentation of the subsequent lists: Put your headphones on and begin when you see the first word. Circle only the 12 words you have learned, and take your headphones off when you are finished.

In addition, the following instructions were given when the subjects were in the rocking condition only: You will notice the chair will now rock. You may rock if you wish.

Each subject responded to the experiment under all auditory and movement conditions in one day. Total time involved per subject, including the break, was one hour.

Experimental Design

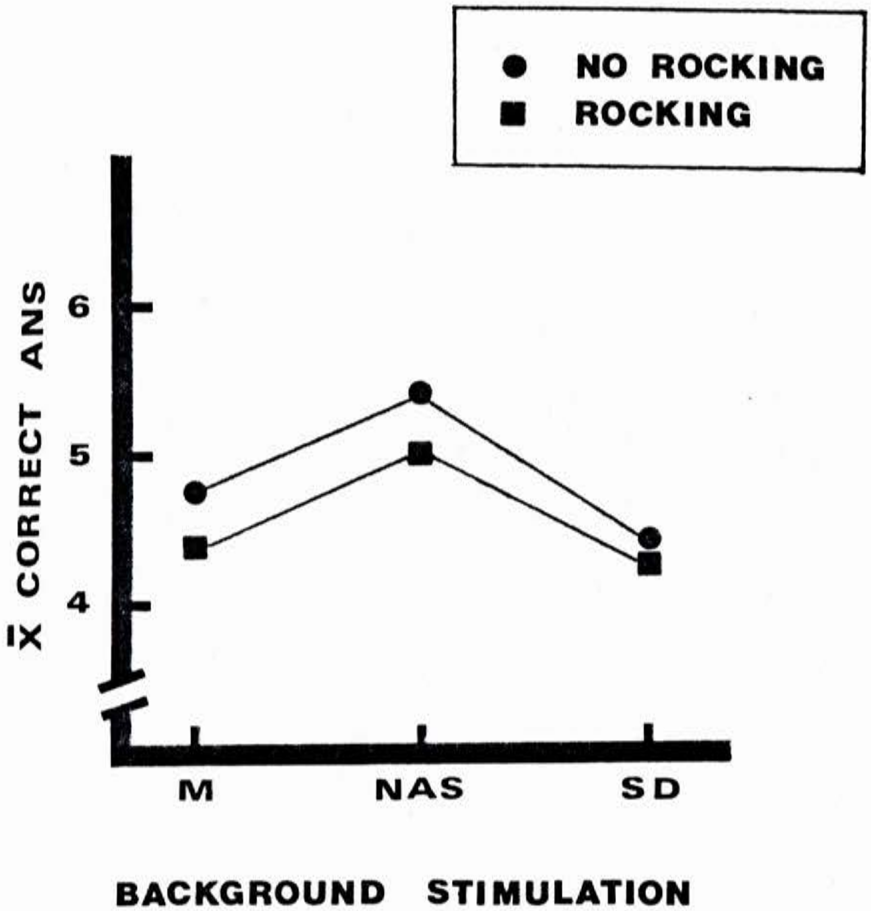
A 2 x 3 factorial (nested) design was used to assess the number of words correctly recognized as a function of the rocking and background stimulation conditions. In addition, two 2 x 2 x 3 factorial designs were used to assess the occurrence of random movement and swaying as a function of phase of the experiment (learning and recall), rocking, and background stimulus conditions. Analysis of variance was used to assess statistical significance. In the statistical analysis of data a trend will be described as having probability levels between .05 and .01 levels of significance.

RESULTS

The hypothesis that ADD students would recall more words and be less active in the presence of background music was not supported by the data. Neither did it appear that movement on the part of the students facilitated recall.

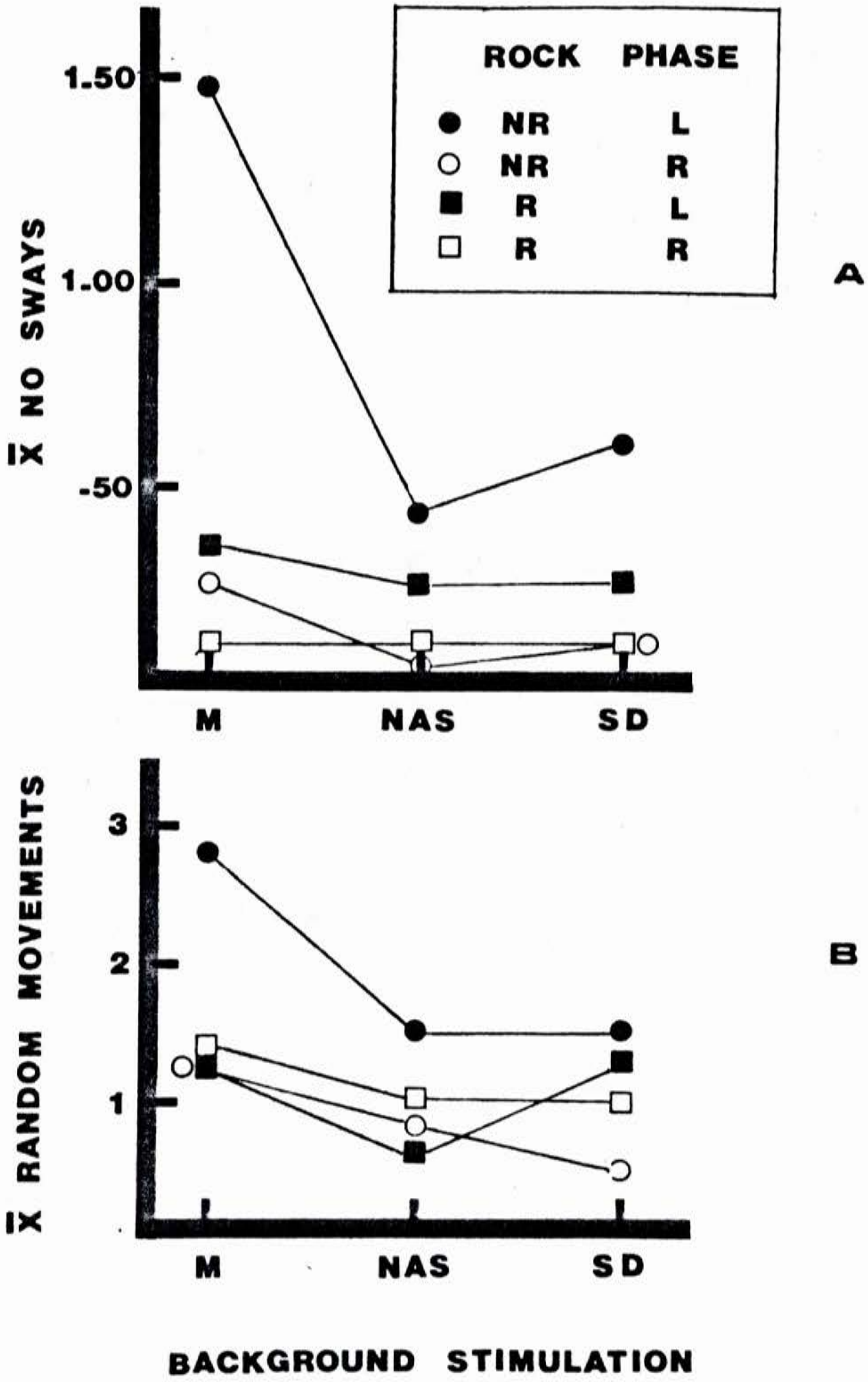
Figure 1 shows the mean number of words correctly recognized as a function of rocking and background stimulation. It appears that more words were recalled in the no auditory stimulation (NAS) than either the music (M) or semantic distractor (SD) treatments. Recognition appears superior under the no rocking than rocking conditions. A 2 x 3 factor variance analysis for nested variables yielded a trend ($F(2, 24) = 2.75$, $p < .08$) toward significance of the auditory stimulus main effect. Subsequent paired comparisons indicated that performance under the no auditory stimulation condition was superior to either of the other background stimulus conditions. Variance analysis indicated that the rocking main effect ($F(1, 12) = .24$, $p < 7.05$) was not statistically significant.

Because students could sway in their chairs, whether or not they could rock, swaying was examined as a


NO ROCKING
ROCKING
X̄ CORRECT ANS
6
5
4
M
NAS
SD
BACKGROUND STIMULATION

dependent variable as a function of phase of the experiment, background stimulation, and rocking variables. Perusal of Figure 2A suggests that more swaying occurred during the learning than recall phase of the experiment. Swaying was especially pronounced during the learning phase under the combined music, no rock condition. A 2 x 2 x 3 factor analysis of variance for nested variables supported the graphical impressions of both the phase of experiment main effect ($\underline{F}(2, 24) = 5.33$, $\underline{p} < .01$) and the triple interaction ($\underline{F}(2, 24) = 4.68$, $\underline{p} < .01$). The main effect of the background stimulation condition was also statistically significant ($\underline{F}(1, 12) = 9.36$, $\underline{p} < .01$). This finding appears largely attributable to the high swaying score (reflected in the triple-interaction) of the music condition for nonrockers during the learning phase.

Random movements were recorded throughout the experiment using a 10-second modified time sampling technique. Each observation yielded an estimate of movement rated on a four-point scale. Figure 2B shows the mean number of movements under the phase of experiment, background stimulation, and rocking conditions. Similar to swaying, the movement was greatest under the learning phase of the sessions, especially when rocking was impossible. Analysis of variance yielded no significant effects. The interraction between phase of the research and rocking condition was statistically significant ($F(1, 12) = 5.32$, $p < .05$).


ROCK PHASE
NR L
NR R
R L
R R
A
1.50
1.00
-50
X̄ NO SWAYS
M
NAS
SD
B
3
2
1
X̄ RANDOM MOVEMENTS
M
NAS
SD
BACKGROUND STIMULATION

DISCUSSION

The findings that ADD students did not recall more information or be less active in the presence of auditory stimulation is consistent with the rehearsal masking hypothesis (Poulton, 1970; Millar, 1979). This hypothesis suggests noise impairs recall relative to quiet in normal rehearsal conditions due to an inability to verbally rehearse material. In the present research the auditory conditions of music and semantic distractor produced lowered recognition than the no auditory stimulation condition. It would appear that auditory stimulation interferred with the verbal rehearsal necessary to successfully place the CVC syllables into short term memory. Verbal rehearsal, however, was not assessed as a variable in this research.

The results of this study are also consistent with one of the oldest and most popular theoretical models of hyperactivity suggested by Strauss (cited in Zentall, 1975). He viewed hyperactivity as a reaction to overstimulation and proposed hyperactive children are unable to ignore irrelevant stimuli. The finding that the subjects' activity level increased as the stimulation increased, especially when they could not rock, would substantiate this theory. The finding that the number of correct responses decreased as the rate of stimulation increased suggested an inability to ignore irrelevant stimuli. The visual stimulation of the task and the motor feedback from responding may be sufficient to reduce the impact of manipulated stimulation.

During the learning phase of the experiment swaying and random movements were greater when no rocking was permitted. When considering both of these variables as random self-stimulation, it would appear the subjects would self-stimulate randomly if not permitted a means of movement such as rocking. These results appear to be consistent with proponents of optimal stimulation theories (Zentall, 1975; Rugel et al., 1978). The child may actually need to be involved in physical movement in order to increase his/her arousal level rather than have it imposed upon him/her by the means of auditory stimulation. Focus may need to be on allowing the child movement, and helping him/her organize the movements rather than attempting to stimulate auditorily which appears to create a distraction.

It is proposed the subjects were unable to function as successfully in the music condition because of the novelty of the experiment. The subjects could have experienced difficulty filtering irrelevant from relevant stimuli in order to attend to the task. This is consistent with studies by Lasky and Tobin (1973) and Cherry and Kruger (1983) who found LD children to have more difficulty with selective auditory attention than normal achievers. Nober and Nober (1975) also found LD children made more auditory discrimination errors in noise than quiet. Reduced performance in the music and semantic distractor conditions also substantiated Fowler and Wilding's (1979) findings of a decrease in correct responses as noise levels increase.

Auditory stimulation could affect the type of memory strategy adopted by the subject. This would explain Millar's (1979) results where he obtained greater success in a noise condition the second day of the experiment. The extended exposure to the experimental situation could give the subjects the opportunity to adopt the appropriate memory strategies on the second day. It is suggested that further research examine the effects of music and auditory stimulation on ADD students over a longer time period where the effects of the novel situation would be minimized and the student could have the opportunity to develop the appropriate memory strategies.

It seems apparent from Wilding and Mohindra's (1980) study that increased subvocalizations may be necessary to facilitate learning in a condition of increased auditory stimulation. According to the developmental lag theory proposed by Tarver et al. (1977), learning disabled students experience a developmental lag in verbal rehearsal strategies needed to subvocalize. In the present research this could only be determined by comparing different age groups. The students in this study, however, may not have the necessary tools to succeed in the conditions of auditory stimulation. They may need to be instructed in verbal rehearsal strategies, first, in order to successfully learn in an environment with background music.

It is important to note in the present experiment and others cited in this paper, the subject had the freedom to attend or not attend to the stimuli, just as ADD students have the freedom to attend or not attend in the classroom. Since it has been determined that students who typically have attentional problems often have learning disabilities (Kendall & Braswell, 1985), these students may also not attend to relevant stimuli as frequently as the average student. It would seem further research should focus on creating environmental situations that could help the ADD student attend to relevant stimuli.

It is further suggested research examine the effects of incentives as an arouser with ADD subjects. The ADD child seems to have difficulty distinguishing relevant from irrelevant stimuli in order to benefit from auditory stimulation, however, may respond positively to incentives as an arouser. If the incentives are appropriately applied, they could help the ADD child distinguish relevant from irrelevant stimuli, and aid in learning while providing constant reinforcement.

It may also be of value to look at the application of music at different times during the day. There may be an appropriate time during the day when arousal is lower when music could be effective to increase productivity. Examination of the effects of background music over an extended period of time would also be of interest. This could reduce the effects of the novelty of the experimental situation.

Findings have indicated the application of background music did not facilitate learning or reduce hyperactivity. Several intervening variables may have contributed to the results of this study. Further research has been suggested that may show more positive effects of music on learning for the ADD student.

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APPENDIX A

Sample Letter to Parents

Sample Letter to Parents

Dear Parents:

In partial fulfillment for my Masters degree in School Psychology, I am required to conduct original research in the area of my primary interest. I will be investigating the effects of various background noises as it relates to learning for students who are easily distracted.

Of the students attending The Learning Center, I have chosen a group of 25 whom I would like to use as subjects for my experiment. It would involve working with your child at The Center for approximately one hour. I would like to schedule the students to come at 9:00 a.m. on weekdays between July 30, 1984 and August 9, 1984.

I would appreciate your permission to work with your child with the hopes we can obtain information about learning environments. I will share the results of this study with you upon completion.

Please sign below, indicate the day or days that would be convenient for you and return to The Center.

Thank you for your help.

Sincerely,

Judy Dessoffy

Child's name ______________________________

Parent's signature ______________________________

Dates available ______________________________

APPENDIX B

Activity Rating Scale

Activity Rating Scale

Point Values

0	no obvious movement
1	one hand or one foot movement
2	one arm, one leg, or head movement
3	two arms or two legs movement
4	whole body movement

Recorded per subject at 10-second time intervals during presentation and recall phases of the experiment.

APPENDIX C

<u>Sample Recall Word List</u>

Sample Recall Word List

beh	feg
biw	cag
kef	gec
fup	qim
quk	vid
kug	woq
paf	yof
xog	yij
vop	qec
wug	yek
cib	zan
vor	xap
bih	vut
iej	cuj
qox	lij
sij	gub
woq	vuf
xof	fep
qiy	xut
gih	zin
zat	jiv

VITA

Judith Holler Dessoffy was born in Buffalo, New York on December 16, 1947. She graduated from Riverside High School in 1965. A Bachelor of Social Work degree was awarded in 1969 from the State University of New York at Buffalo.

Between the years 1969 and 1971 she was employed as a social worker at Thomas Jefferson University Hospital, Philadelphia, Pennsylvania. In 1975 she developed and administered a medical social work department at Gordon Crowell Memorial Hospital, Lincolnton, North Carolina where she remained for one year. During the years 1979-1982, she was employed as a family counselor at the Family Guidance Center, Hickory, North Carolina. In 1981 she assisted in the development of The Learning Center of Catawba County, Hickory, North Carolina where she is currently employed as Associate Director.

In 1983 she entered Appalachian State University and was awarded a Master's degree in the field of School Psychology. The author is a member of the National Association of School Psychologists, North Carolina School Psychology Association, and American Psychological Association, Division #16.

Ms. Dessoffy is married to Emery Dessoffy and has two children: Travis, age 13, and Tara, age 11. She resides with her family at 655 - 21st Avenue, Northwest, Hickory, North Carolina.