

White Noise and the Learner  
Using White Noise in Limited Resource Environments

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by

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This Master's Research Project has been approved  
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## **White Noise and the Learner: Using White Noise in Limited Resource Environments**

In classrooms today, the student is confronted with a deluge of auditory distractions. These distractions inhibit learners' abilities to concentrate on a given task (Choi & McPherson, 2005; Maag & Anderson). For learners with attention deficit hyperactivity disorder (ADHD), the impact of ambient noise is even more prohibitive to their education (Levy, Hay, & Bennett, 2006; Marshall, Hynd, Handwerk, & Hall, 1997). As a result, there is a need for schools to find a cost effective way to minimize the impact of ambient noise in the classroom. The use of white noise during quiet work time may offer some help allowing students to focus, thereby having the potential to positively impact their achievement.

### **Literature Review**

Previous studies have shown that the noise level in the classroom can have a negative impact on learning for all students in the areas of attention and behavior. Noise caused by traffic, scraping chairs, children on the playground, from the hallway, and from conversation are some of the culprits (Choi & McPherson, 1995; Johnson, 2001; Palmer, 1997). A noisy environment's impact is magnified for students with ADHD due to the characteristics of this disorder (Maag & Anderson, 2007).

### **Characteristics of ADHD**

It is important to note that in general, children with ADHD tend to academically perform lower than their peers without ADHD and consistently perform below their expected ability level as compared to their measured intelligence (Maag & Anderson, 2008). Due to the characteristics of this disorder, a peaceful work environment is crucial. Attention deficit- hyperactivity disorder (ADHD) is characterized by inattention, hyperactivity, and impulsivity (Lavoie, 2008).

ADHD is broken down into three major categories: predominately inattentive, predominately hyperactive, and combined type of ADHD (National Dissemination Center for Children with Disabilities, 2008). Students with the combined type of ADHD are the focus of this study because it is the most prevalent type of ADHD seen in the schools. As many as 55% of learners with ADHD are listed as having the combined type of ADHD (Raymond, 2008).

A student with ADHD is likely to experience many of the following symptoms: lack of attention to detail, inability to focus on a given activity, not following instructions, leaving things unfinished, disorganization, high distractibility, often misplaces items, fidgeting, constantly on the move, inappropriate loudness, incessant talking, interrupting behavior, and inappropriate joining of conversations and activities of others (National Dissemination Center for Children with Disabilities, 2008). With one of the most prevalent symptoms of ADHD being an inability to focus, something needs to be done for these learners to quiet the classroom in order to assist them in focusing their attention on relevant stimuli.

### **Interventions to Improve the Classroom Environment**

There are resources available to control ambient noise in the classroom such as acoustical panels, acoustic liners in duct work, vinyl paneling inside the walls, and the installation of carpeting (Crandel & Smaldino, 1999; Johnson, 2001). The previously cited author suggests the use of panels, however there was no study conducted to support their effectiveness. Though the author suggests these panels are cost effective, they can cost thousands of dollars per classroom and also require professional installation.

Another suggested approach to help all learners in a noisy classroom is sound field amplification, which seems to truly help the learner hear the teacher's voice through the extraneous noise. In this type of amplification, a system is set up in the classroom using speakers

placed throughout the room and the teacher uses a microphone attached to a headset. The sound of the teacher's voice is then amplified for the students. The system can also be altered to have just the students who need the teacher's voice amplified, use headphones, and the teacher's voice goes directly to their ears. A significant barrier is that it currently costs between seven hundred to one thousand dollars per classroom to install (Starkman, 2007).

The use of alpha rather than beta commands is also suggested to be effective and is a free intervention for any teacher who wants to practice it (Bradlow, Kraus, & Hayes, 2003). When a teacher is giving an alpha command he/she is giving a short and direct instruction to the students. An example of an alpha command is the teacher saying, "Take out your science book and turn to page 52." The command is short, direct, and does not include any extra words. What has not been considered by these interventions is quiet or seat work time.

While recognizing that all learners may have difficulty with ambient noise in the classroom, two existing studies focused on ways to improve the students' ability to hear the teacher's voice (Bradlow, Kraus, & Hayes, 2003; Starkman, 2007). This is a very important issue, but this is not the only area in which noise in the classroom is having a negative impact. Three of the studies discussed above suggested environmental changes to the classroom to reduce ambient noise, but the procedures are too costly for many school districts to employ them (Crandel & Smaldino, 1999; Johnson, 2001; Starkman, 2007). Throughout a given school day, there are times when students are expected to quietly complete tasks on their own. The noise level in the classroom is just as great an issue at these times as when the teacher is speaking.

### **Summary**

The purpose of this study is to see what, if any, impact white noise has on the learner during quiet, independent work time. In this study, white noise such as a fan, a white noise

machine, ocean waves, or the sound of running water would be used to mask ambient noises in the classroom.

The cost of a basic white noise machine is approximately \$50.00. It is small, easily portable, and can be used to mask background noise. Other less expensive options come in the form of MP3 downloads or compact discs that play twenty minutes to one hour of soothing sounds like babbling brooks or ocean waves. The cost of these items range in price from approximately \$7.00 dollars to about \$20.00 ([www.WhiteNoiseStore.com](http://www.WhiteNoiseStore.com), 2008). The price of a basic fan from any discount store is between \$15 - \$40.

The research question addressed in this study examines the use of white noise in the classroom on the learner. Does it have an impact on attentiveness and if so, what type of impact? Does making the proposed environmental change improve the focus and learning of students with ADHD?

This study suggests that distraction is an issue in the classroom. If this is true, then by making an environmental change, masking ambient noise in the classroom, students will show an increase in time spent focused on a given task. The hope is that more focus on academic tasks will lead to less disruptive behavior, higher quality of work, and better educational outcomes for students.

### **Methods**

The design for this study was a single subject AB case study. Each phase of the study includes five data collection points taken on different days. Each data collection point lasted for ten minutes and the time spent off task during these ten minutes were calculated for each data collection point.

## **Location**

This study was conducted in a rural community in South Eastern Ohio. This area has a high poverty and high unemployment rate. The student-to-teacher ratio in the school is roughly seventeen students for each teacher in the school building. In the classroom where these students receive most of their instruction and spend the bulk of each day, there are several students from the local university who come in daily to complete observations and engage in activities with the students. This allows for more supervision of the students who need it. The classroom used for the study was a first grade room. The classroom teacher has more than 20 years of experience and holds a masters degree.

## **Participants**

With the help of the classroom teacher, two students were selected to participate in this study. The first student, who will be referred to as Amy, was selected because she generally does not have problems completing her work, following directions, or staying on task. The second student, who will be referred to as Jane, was selected because she has trouble following directions, staying on task, completing her work, and paying attention to details. She also frequently exhibits behaviors such as talking out of turn, talking in an overly loud voice, leaving her seat at times when it is not permissible, and occasionally engaging in physical activities that are not a part of the task she has been assigned. Some examples of unassigned physical activities would be cutting at a glue bottle with scissors while she was supposed to cutting pictures out of a magazine to make a collage and tearing pictures out of the magazine instead of cutting them out. She might also be seen bouncing up and down on the pillow chairs and changing her book as many as five times instead of quietly reading with her peers during silent reading time.

The girls in the study are both six years of age. They are first graders at the same elementary school and are in the same classroom. Neither girl has an Individualized Education Plan (IEP) or receives any special education services. Neither is receiving any type of systematic behavioral interventions. The students come from middle income families. Jane lives with both of her parents and her older sister. Amy lives with her mother and her two teenage sisters. Amy's father is deceased. In each case, their parents work, all of the parents have some form of higher education, and all of the parents hold professional jobs. Both girls have parents who are supportive and actively involved in their daughters' education.

### **Procedures**

The first (A) phase of this case study involved a video recording of the students' off task behavior as they participated in their daily scheduled activities within the classroom where they received the bulk of their instruction. The second (B) phase took place in the same classroom during the same activities, with video recording of students' off task behavior, but with the addition of white noise being played in the classroom. The classroom teacher selected the sound of ocean waves, which was played on a small portable compact disc player.

The choice of AB design was selected as it can be done in any classroom and this type of study can provide strong causal data. The researcher conducted all of the observations and the observations were recorded using a video camera. The researcher also visited the classroom at pre-determined times as needed to back up the data being recorded on the videos.

The video camera was set up in the classroom for seven days before any data was gathered. It was placed in the room ahead of time to allow the students to get acclimated to the thought of being recorded. The A phase of data collection lasted for 5 consecutive days. The B

phase of data collection lasted for four consecutive school days going Monday through Thursday and the last day of data was collected on the following Monday.

In each data collection session the observer spent 10 minutes observing each student. On some days the observation was back to back from one participant to the next. On some of the days the observation period was conducted simultaneously with the use of the video recording. On the days when recorded data was used the observer took the disc home and recorded the time spent off task in the same manner as when live data was being gathered. When taped images were being used the observer set the video camera in such a way that the student being observed had their face and body pointed at the camera. The camera was always within 10 feet of the child being observed for the data collected at such times.

Time off task was measured using a timer. The observer noted the exact start time on the classroom clock and then watched the participant who was being observed. When the child began to exhibit any of the behaviors that are described in this study as being off task, the observer started the count up timing feature on the digital timer. The duration of the off task event was immediately recorded onto the appropriate section of the data collection sheet.

Data collection happened between roughly 10:30 and 11:30 am each day. This is the regularly scheduled time for reading centers daily in this classroom. The observer would quietly enter the classroom, turn on the camera, turn on the white noise (B phase only), take a seat and check the time on the clock. The observer always waited for the second hand on the clock to reach 12 to ensure that the start time was exact. The observer made observations and wrote down the duration in minutes and seconds of any incidents of off task behavior. At the end of the 10 minute observation period, the observer either began the process again with the second participant or rechecked the camera and quietly left the room.

## **Data Collection**

Duration recording was used in both phases of the study. The researcher recorded the duration of incidents of off task behavior exhibited by the two target students. For the purposes of this study, off task behavior was defined as times when the student was not following directions, looking around the classroom for more than a few seconds, when the student was not actively working on the prescribed task of the moment, disrupting the work of others, unauthorized out of seat behavior, and or engaging in overly loud and disruptive talking.

The observations were taken each day during reading centers, a daily period lasting approximately 1 hour to 1 hour and 15 minutes. Reading centers generally begin around 10:30 and last until around 11:30 or 11:45. This is a regularly scheduled classroom activity that the students complete in the same room where they receive the bulk of their daily instruction.

During reading centers, students are asked to engage in directed independent work. Many of these tasks are completed without direct adult supervision. The students are given directions for each center and then sent to the first of several centers that they rotated through during the day. Reading centers happen in this classroom during the late morning hours, usually beginning around 10:30 a.m. and lasting until approximately 11:15 or 11:30 a.m. Center activities include stamping or writing the weekly spelling words, selecting and reading a book, completing phonics pages, and creating visual representations of a topic such as doing a painting about things for which the students were thankful.

## **Instruments**

The materials used to conduct this study were a video camera, discs for recording, duration event data recording sheets (see Appendix for an example), a timer, and a pencil. A compact disc player and a compact disc with the sound of ocean waves were used to introduce

white noise into the environment during phase B of the study. Permission slips signed by parents or guardians for all student participants were collected. The permission slips included a full description of the study and its purpose. Written approval from a school’s principal and university approval from Internal Review Board (IRB) for the use of human subjects was also obtained.

### **Results**

Listed in Tables 1 through 4 are the data collection days and the daily totals of time off task by each participant. Tables 1 and 2 provide a summary of the data for both participants in the A phase of data collection. Tables 3 and 4 show the daily data for the B phase of data collection for each participant.

Tables 1 and 2 represent the time each student spent off task during a given ten minute period each day over a one-week period. These results are from the A phase of data collection. Jane spent an average of 3.9 minutes out of ten off task while Amy spent an average of 1.17 minutes out of every ten off task.

Table 1

*Baseline Time Off Task for Student Without Attention Issues (Amy: Control)*

Dates	Minutes
10/25	0.55 min.
11/01	1.22 min.
11/02	0.56 min.
11/03	0.53 min.
11/04	0.29 min

*Note.* Average time off-task = 1.17 minutes

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Table 2

*Baseline Time Off Task for Student With Attention Issues (Jane)*

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Dates	Minutes
10/25	3.51 min.
11/01	3.35 min.
11/02	3.53 min.
11/03	1.47 min.
11/4	2.41 min.

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*Note.* Average time off-task = 3.09 minutes

Tables 3 and 4 show both the A and B phase data for both participants. The B phase data shows the amount of time target students were off task during a 10-minute period when white noise was introduced into the environment.

Table 3

*Intervention (Phase B) Time Off Task for Student Without Attention Issues (Control)*

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Dates	Minutes
11/8	3.45 min.
11/9	1.42 min.
11/10	1.18 min.
11/11	1.42 min.
11/15	1.21 min.

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*Note.* Average time off-task = 2.29 minutes

Table 4

*Intervention (Phase B) Time Off Task for Student Without Attention Issues (Jane)*

Dates	Minutes
11/8	8.41 min.
11/9	0.53 min.
11/10	1.37 min.
11/11	6.47 min.
11/15	1.25 min.

*Note.* Average time off-task = 4.24 minutes

**Discussion, Implications, and Conclusions**

**Interpretation of Results**

Tables 1 and 2 report the daily totals and weekly average amount of time in minutes that each participant spent off task during the 10-minute data collection periods. A comparison of the two tables shows that Jane spent an average of 3.09 minutes off task while Amy spent an average of only 1.17 minutes off task. Jane spent nearly three times as much time off task as Amy during the data collection time period. This provides additional support to research that indicates students with attention issues have trouble staying focused on a given academic activity. These results indicate that time off task could be a factor in the lower academic achievement of some students with ADHD.

**Amy: Day 1.** Table 3 shows the daily breakdown and weekly average for minutes spent off task for Amy during phase B of the study. On the first day of A phase data collection, Amy spent a total of .55 seconds out of 10 minutes off task. When white noise was introduced on the first day of phase B, Amy spent a total of 3.45 minutes out of 10 minutes off task. This is nearly

4 times the amount of time spent off task than on the first day of the A phase without the use of white noise.

**Jane: Day 1.** Table 4 shows the daily breakdown and weekly average for minutes spent off task for Jane during phase B of the study. On the first day of A phase data collection, Jane spent a total of 3.51 minutes out of 10 minutes off task. When white noise was introduced on the first day of phase B, Jane spent a total of 8.41 minutes out of 10 minutes off task. Jane spent more than two times as much time off task as the first day of data collection in the A phase where no white noise was used.

These results indicate that the introduction of white noise on the first day was distracting for both Amy and Jane. In later conversation with the classroom teacher, she indicated that the whole class was less productive and that the students in the entire class had displayed more off task behavior than usual throughout the course of the entire day. This may have some bearing on the data that was collected on that day. The white noise was only used for about 22 minutes the first day. It was turned off immediately after the data collection for the day had ceased. Another factor to be considered is the proximity of the white noise to Amy and Jane. The centers that the girls were engaged in on the first day at the time of data collection were across the room from where the white noise was playing.

**Amy: Days 2 & 3.** An analysis of days 2 and 3 (Table 3) for phase B there is a dramatic reduction in the amount of time Amy spent off task, but it is still higher than the mirroring days from the week before when no white noise was being used. Amy spent approximately 20 seconds more time off task than she had the first week on the second and third days. On both of these days, Amy was participating in centers that were located in close proximity to where the white noise was being played. With such similar results 2 days in a row and taking proximity into

account it can be reasonably assumed that the white noise had an adverse effect on the amount of time Amy spent on task.

**Jane: Days 2 & 3.** Jane's results were quite different from Amy's on the same two days. During day 2 of A phase, Jane spent 3.35 minutes off task as opposed to .53 seconds off task during day 2 of B phase. This is more than three times less time spent off task than on the mirroring day of the week without the use of white noise. On day 3 of A phase, Jane spent 3.53 minutes off task and on day 3 of B phase, she spent 1.37 minutes off task. This is close to half as much time spent off task as the mirroring day the week before. On both of the days in question, Jane participated in centers in close proximity to where the white noise was being played. With noticeable results two days in a row and taking proximity into account, it might be assumed that the use white noise had a positive effect on the amount of time Jane spent on task.

**Amy: Day 4.** On the fourth day of Phase A, Amy spent 0.53 seconds out of 10 minutes off task. On the mirror day during the B phase of data collection, she spent 1.42 minutes out of 10 minutes off task. This is about two times the amount of time spent off task. This indicates again that the use of white noise may have been distracting for Amy.

**Jane: Day 4.** On the fourth day of Phase A, Jane spent 1.47 minutes out of 10 minutes off task. On the mirror day during the B phase of data collection, she spent 6.41 minutes out of 10 minutes off task. This is more than three times the amount of time spent off task. This indicates that the use of white noise may have been distracting for Jane.

**Amy: Day 5.** On the final day of Phase A, Amy spent 0.29 seconds out of 10 minutes off task. On the mirror day during the B phase of data collection, she spent 1.21 minutes out of 10 minutes off task. This is about three times the amount of time spent off task. This indicates again that the use of white noise may have been distracting for Amy.

**Jane: Day 5.** On the final day of Phase A, Jane spent 2.41 minutes out of 10 minutes off task. On the mirror day during the B phase of data collection, she spent 1.25 minutes out of 10 minutes off task. This nearly a 50% reduction in time spent off task. This again indicates that the use of white noise may have been beneficial for Jane's amount of time spent focused on her work.

**Amy & Jane: Day 5 Phase B.** On the last day of Phase B, the girls experienced two disruptions to their normal schedule and activities. This was the first day that the students from the nearby university were not present to work with the children during reading centers. The visiting university students had finished their time with the class. Directly before reading centers, the students attended a Veteran's Day assembly with all the other students in the school. The assembly was held in the gymnasium and lasted for about 45 minutes. It must also be stated that on this day, the students were again participating in centers on the other side of the room from where the white noise was playing.

On the final day of data collection for the B phase of the study, Jane was seated within five feet of the compact disc player that was playing the white noise while Amy was about 13 feet away from the disc player. This was the third day where Jane was working near the sound of white noise and experienced a reduction in off task behavior. For Amy the reverse was true. She wasn't as close, but she was within hearing range and again exhibited an increase in time spent off task.

**Weekly averages.** If just the weekly averages of time off task are examined, both girls showed an increase in time off task with the use of white noise. Amy went from an average of 1.17 minutes to an average of 2.29 minutes spent off task with white noise being used in the environment. Jane went from an average of 3.09 minutes to an average of 4.29 minutes spent off

task with the use of white noise. These averages may be misleading due to other factors such as proximity of the white noise to the students, changes in the daily schedule, and the absence of the university students. These factors make the weekly averages suspect in terms of their validity.

The three days where both girls were within hearing range of the white noise show consistent changes in the amount of time spent off task. For Amy who has no attention issues, the use of white noise increased her off task behavior. For Jane who has attention issues that are consistent with many of the symptoms of ADHD, her off task behavior decreased with the use of white noise.

### **Validity Concerns**

This study was conducted in a short amount of time and more controlled circumstances in the environment would be needed to address this research question. The changes to the students' routines and schedules during the last three days of data collection of the B phase of this study makes the validity of the data collected on those days questionable. Another weakness of this study is that no previous direct data or studies could be found as to the effects of the use of white noise in a classroom setting. The last concerns are about the sample size and settings. This study was conducted using only two students and in a very limited setting. The results of this study may not generalize to a larger population and to more varied settings.

### **Future Implications**

The use of white noise may be useful in select environments and during select activities to help students who either have ADHD or issues maintaining focus on academic activities. Using white noise during quiet work time, centers, silent reading, and even during homework time, may be an effective intervention for these students. Conversely some students may find the use of white noise during these times as somewhat distracting.

Similar studies in more controlled settings should be conducted to either confirm or negate the findings of this study. In this study, the data suggested that proximity to the sound of the white noise might be a factor. Future studies should be conducted to verify these results.

### **Conclusions**

There is need for a cost effective solution to the issue of a noisy classroom. This issue may be affecting the academic progress of all students and in particular, students with ADHD. White noise machines, fans, and disc players with compact discs are inexpensive; require no installation, and do not require permanent structural changes. Teachers could purchase and set up these materials by themselves and use them as desired. The findings in this study suggest that if a student who has issues with maintaining focus on academic activities is within hearing range of white noise being played, they may experience a decrease in off task behavior. Due to the fact that white noise seemed to be consistently distracting for a student without attention issues, the use of white noise would need to be limited to use for students with attention issues.

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## Appendix

Name _____												
Definition of behavior being recorded _____												
_____												
_____												
Duration												
Obs.	Date/											Daily
initials	time	Start	Stop	total								