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# The Effect of Background Baroque Music on Work Accomplishment and Student Concentration on Days of Rapid Weather Changes.

Dayani A. Pieri
*St. Catherine University*, dspieri@stkate.edu

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Dayani S. Pieri

St. Catherine University

St. Paul, Minnesota

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St. Paul, Minnesota

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## Abstract

This study used Baroque background music to mitigate the effects of weather variables on 12 students of a Montessori elementary classroom. The weather forecast data were gathered from the National Weather Service. Two student feedback forms gauged attitudes towards the music and academic activities, focus, and accomplished work. A teacher tally chart marked daily observations of behavior. The study utilized Microsoft Excel with methods of descriptive data analyses, t-tests, and regression analysis. Student appreciation of music varied, but the children's affinity for music remained high. It is unclear whether the music created a positive mindset. The Baroque background music contributed to higher work accomplishments on days of greater barometric pressure, sky cover changes, and lower changes in precipitation potential. The results of background music on concentration are inconclusive, however, over time, student focus increased with the intervention. A longer duration of study may confirm the findings presented here.


*Key words*: Baroque music, concentration, elementary students, Montessori, weather variables, work accomplishment

Artists from Mother Goose to the Beatles have created poems and songs related to the weather. The Itsy Bitsy Spider gets washed out by the rain, but the return of the sun helps the spider ascend the spout again. The rain also hindered Little Tommy's play time and triggered the old man's snoring. The song titled, "Weather Song" (Preschool Education, 1997) composed by an unknown author reads, "The weather is a funny thing…, it changes every day."

Contrary to the Weather Song, the National Weather Service forecast's weather patterns alter not just on a daily basis but also on an hourly basis. The air temperature changes and the amount of solar energy present throughout a particular day change our weather. Both very high and low temperatures have the ability to cause us distress. The increase in air temperature raises the barometric pressure in an area. The winds then blow to balance these pressure changes. Fast moving wind gusts can cause damage to property and create calamitous conditions as we are seeing these days.

The temperature also has a relationship to relative humidity which relates to the moisture content in the atmosphere. It tells us the amount of water vapor in the air. High relative humidity can create discomfort due to our inability to sweat and cool ourselves. Relative humidity records the saturation level of air as a percentage. Unlike air pressure, this meteorological condition is inversely proportional to temperature. Therefore, when the temperature rises, the relative humidity decreases. Dew point operates independently of temperature. The air cooled to the temperature of the dew point becomes saturated, and condenses below the dew point. This condensation can manifest itself as rain, drizzle, snow, sleet, freezing rain and hail which are all types of precipitation. These meteorological phenomena affect us in the way we dress and the way we conduct our day to day lives.

Do these weather variations affect the mood and behavior of children? There is empirical evidence to suggest so. Also, educators express anecdotal episodes concerning students' behavior and performance related to weather changes. T. M. Ripple mentioned how she could always tell barometric pressure changes through the activities of her students (personal communication, February 6, 2017). N. Bradtmiller suggested that the moon cycles have a correlation to students' behavior as observed by her supervisor (personal communication, 2016). The stories are numerous. In my teaching experience, I have witnessed a variety of behavior changes that could be attributed to these meteorological changes. A very calm, concentrated, and engaged group of students suddenly become loud and disengaged from their work and begin to walk around. An energetic group that walks into the classroom in the morning that doesn't show signs of academic productivity gradually calms down and concentrates on the tasks at hand collaborating and cooperating with each other. Some days, students enter the classroom with a happy demeanor but not so on other days. One could argue that as individuals we all have our favorable and unfavorable days, but when a group as whole displays similar emotional attitudes or behavior, then one has to pause and take note. One has to investigate the reason for the phenomenon.

If indeed these attitudes, moods, and behavioral episodes are a result of rapid, hourly weather shifts, then the question remains whether these changes have a detrimental effect on a child's concentration level and thereby affect scholarly productivity. Do these altering weather attributes disconnect the engagement that children have to their tasks? If so, will changing the classroom ambiance or the atmosphere help redirect the students on days of rapid weather changes?

Investigations point to certain genres of music as sources of comfort and happiness that alter mood. Playing background music that is conducive to creating such a calm and happy environment may modify a student's distracting mentality. Studies also indicate that some types of music may even have a distracting effect on task performance and concentration (Chou, 2010). Therefore one must carefully select the genre of background music when attempting to change the ambiance of a classroom to a calm, learning atmosphere.

In the quest of creating a more tranquil environment for my students of six to nine years, in a Montessori elementary classroom in the Midwestern region of the United States, I decided to implement baroque background music on alternating weeks to investigate the impact it has on concentration and academic productivity. Baroque music is an early European classical style music played during 1600-1750. The Baroque Era stands between Renaissance and the Classical Eras and forms the major portion of the classical music cannon. The composers of the Baroque Era include Johann Sebastian Bach, George Frederic Handel, Antonio Vivaldi, and Johann Pachelbel among others.

We encounter background music as we walk into many locations such as restaurants, shops, banks, hotels, and even hospitals. Today, the music is also controlled in a way to impress the customers as they walk into a store. Beverland, Lim, Morrison, and Terziovski (2006) studied the effects of background music on customer and brand relationships. They concluded that the right music entices a customer to enter the store and begin a brand-relationship. This brand effect because of the music could be a transformational, delightful, and loyalty creating experience (Berverland et al. (2006). Empirical studies also suggest that background music increases the level of attention given to a particular task (Shih, 2008).

## Literature Review

According to the keen observations of Dr. Maria Montessori, children divide into four planes of development. There are differing needs, behaviors, and characteristics that manifest in each of these planes, and they correspond to the phases of physical growth or the successive personalities of the child (1984, pp. 29-38). The more fully the needs are met in one period, according to Montessori, the greater the success in the next (p. 194). Unmet requirements cause deviations to manifest (p.194). These deviations (Montessori, 1966) could be the result of the inability of a child to complete a task (fugues), the lack of purposeful activities to be engaged in (barriers), inability to resist the influence of an adult (attachment), desire for power, inferiority complex, fear, lying, giving into unfavorable conditions, and lack of interest in things that stimulate development but possessiveness towards material things (1966, pp. 154 – 176). Montessori stated that engaged concentration is a way to remove these defects that are manifested in a child (1984, p.206).

Concentration is an essential aspect of children's development (Montessori, 1984, p.220). The ability for children to engage in and focus on tasks is also an important quality of an effective learning environment. Lack of these components in a student's work day could result in declined academic productivity. Focusing on a task that arouses interest and involves the child's whole personality brings about success. However, Montessori contrasted concentration with mere occupation. The latter does not engage the whole child but enables him to move from task to task even while using the materials appropriately (Montessori, 1984, p. 206). Montessori claimed that "the child who concentrates is immensely happy" (Montessori, 1984, p.267).

The reasons for losing focus and engagement in a task could be the result of mood changes or some discomfort the individual is experiencing at a given time. Mood changes could stem from internal or external stimuli. Anecdotal episodes expressed by P-12 teachers indicate that weather has an impact on student behavior. In one of a few studies, Dexter (1904) inquired into the effects of weather on children's behavior by working with 86 teachers from around the United States. These teachers had unanimously stated that weather influences children's conduct and their work. Examining the teacher folklore that student behavior has a link to weather; Badger and O'Hare (1989) concluded that day-to-day weather conditions, in addition to other variables such as school practices, may have an effect on disruptive behavior. Dabb (1997) concluded that her study substantiated the teachers' years of suspicions regarding the correlation between meteorological conditions and behavior. Her examinations showed that daily atmospheric changes affected the concentration levels of student groups in 12 elementary classrooms located in two schools. It may be possible in some instances to remove an external distraction that hinders engagement from a learning environment, but to change an aspect of the weather to improve focus is a difficult task. Weather includes atmospheric conditions such as air temperature, barometric pressure, relative humidity, precipitation and other constantly changing meteorological, atmospheric phenomena that influence us in the way we live, dress, and conduct our activities (Dabb, 1997). For this reason, an educator can creatively employ strategies that improve mood, concentration, and thereby enhance the academic performance of the students hindered as a result of weather variables.

One of the methods used to enhance mood is music. Ter Bogt, Mulder, Raaijmakers, and Gabhainn, (2011) have stated that music has soothing qualities.

Gathering a typology of music listeners in their study, Ter Bogt et al. (2011) found that music was appreciated by most due to its enriching and invigorating effects on life. The participants in this study gave importance to music due to its ability for mood enhancement, coping with problems, and defining personal and social identity. In addition to these emotional effects on music, Sarkamo et al. (2008) highlighted that music activated brain regions that are related to attention, semantic processing, memory, and motor functions. They concurred that music exposure enhanced emotional and cognitive functioning not only in the healthy but also in patients.

**Meteorological phenomena and human affect**

Throughout time, researchers have been finding that there is a relationship between weather phenomena, human behavior, and performance. In a study conducted to examine the relationship between temperature, humidity, air quality, and work performance, the researchers discussed that all these conditions have an impact on employee performance (Realyvásquez, Maldonado-Macías, García-Alcaraz, Cortés-Robles, & Blanco-Fernández, 2016). Their study concluded that when the conditions are moderated work performance can be improved.

According to Denissen, Butalid, Penke, and van Aken (2008), meteorological variables have a link to a variety of human moods. They attributed sunny days to behaviors of happiness. Keller et al. (2005) studied the relationship between mood and weather variable changes in seasons and the time spent outdoors. According to Saunders (1993), even the United States stock market showed higher indices on sunny days than on gloomy days.

In addition to examining the effects of the hours of sunshine, a study conducted in the 1980's examined humidity, temperature, barometric pressure, and precipitation on

mood (Howarth and Hoffman, 1984). The study supported the hypothesis that weather is a significant predictor of a majority of mood dimensions examined, and that humidity had the greatest influence (Howarth & Hoffman, 1984). Some of the mood variables studied included concentration and potency. The authors defined potency as a measure of self-confidence and self-assurance which was related to performance. The results confirmed that the increase in humidity caused the decrease in concentration and potency and increase in sleepiness. These results concluded that the increase in humidity may not only decrease concentration but also performance. They also discovered that the rise in barometric pressure caused focus and control levels to be elevated and fatigue levels to fall. They noted that two other variables, temperature and hours of sunshine, affected concentration. Their study also correlated with the study of Dexter (1904) conducted eight decades prior, which stated that days with increased humidity led to decreased concentration of children throughout the nation. Second and third places in importance for declining concentration were seen on days of high temperature and wind according to Dexter (1904). Badger and O'Hare (1989) agreed that there is a correlation between temperature, wind, and pupil behavior but emphasized that the behavior is related to wind speed and temperature fluctuations throughout the day. Recently in 2007, Wargocki and Wyon showed that providing some means of avoiding elevated temperatures would improve educational attainment. Even though there are many studies done to observe the relationship between weather patterns and behavior changes, Dabb (1997) pointed out that studies of mood changes against rapid daily fluctuations (as mentioned by Badger & O'Hare, 1989) in meteorological phenomena are scarce.

VanBuskirk and Simon (2013) conducted a study of classroom behavior relative to daily meteorological conditions with three subjects who suffered from autism spectrum

disorder (ASD). They concluded that there was only a weak relationship between behavior and academic performance to weather variables. The ASD subjects were examined during an hour in a day against barometric pressure, temperature, moon phase, and humidity. The study concluded that there is little empirical evidence to show that the meteorological variables were a factor in the subjects' behavior or academic performance. Keller et al. (2005) stated that correlations between weather and mood examined have resulted in conflicting outcomes. They identified that there is much research conducted to examine the relationship of seasons on mood and depression but that there have not been many studies done to assess the effect on daily occurring weather fluctuations on human mood and cognition.

**Music, mood, and concentration**

According to Garrido and Davidson (2013), most music lovers claim that music has the power to alter moods, help relax, enjoy a pleasant state of mind, and also bring the listeners to heights of happiness and better health. They say that the use of music in the health field today as a mode of therapy is an accepted practice. Thomson, Reece, and Di Benedetto (2014) conducted a survey to examine the effectiveness of music, concluding that mood regulation was one of its functions. According to Garrido and Davidson (2013), using music for mood regulation is not a modern concept but one that dates back to the ancient Greeks. Iamblichus, the biographer of Pythagoras, noted that Pythagoras believed in the influence of music modes on changing mood, therefore, he developed tunes to counteract anger and despair (Garrido & Davidson, 2013) .

Garrido and Davidson (2013) concluded that the long time association of music with mood regulation in our history speaks to its effectiveness to influence human emotions. In contrast, many scholars believe that people in ancient times listened to

music mainly for social reasons. Today one of the main reasons people listen to music is to maintain a pleasant mood and to create a comfortable space. To enhance the mood, stated Thomson et al. (2014), the music must not involve deep awareness but used as a background strategy. However, Wilkinson (2013) contradicted that there are extensive and varied benefits of exposure to certain types of music, whether used as active listening or as background music. Montessori stated that the children's environment must arouse a feeling and understanding of music (1967, p.286).

Strachan (2015) examined the effects of background music on student focus and concluded that music had a positive effect on concentration. She found that relaxing, soft music improved the attention of students. Strachan emphasized the importance of the type, volume, and tempo of the music that should be used to enhance concentration. In her experiment, she used instrumentals that were at a low volume carrying a slow tempo. Wilkinson (2013) also came to a similar conclusion as Strachan (2015) and agreed that the right kind of music had the potential to improve mood, enhancing comfort and relaxation, to create a positive learning environment. What is the right kind of music then? After several years of experimentation in the Model Montessori School of Vienna by Laurence A. Benjamin with the assistance of distinguished musicians of London and Vienna, Montessori (1967) declared that folk and classical music of different countries were the desirable types of music (p. 286). According to Franco et al. (2014), the right kind of music is the music that matches how it affects the listener at a given time. It is not even the type of affect the music elicits, but in the case of younger children, it is the matching of the perceived effect of the music to their feelings. Franco et al. (2014) declared that in such instances the music improves the cognitive performance of the young and adult listener. Strachan (2015) observed that on days the background music

was utilized, her students displayed behaviors of happiness, less agitation, and were more productive in the classroom. Also, student assessments revealed that the background music reduced sad and angry moods.

**Music and productivity in learning**

It is important to examine whether creating a relaxed, comfortable environment with music will enhance productivity in educational settings. The relationship between music and cognitive benefits were seen as early as the time of Pythagoras, the mathematician of the 5th century BCE. To Pythagoras and his followers, music and math were inseparable entities. Music and mathematics connection could be traced even further back into the past where clay tablets of 2000 BCE were discovered through recent excavations. These findings depict standardized mathematical ratios of stringed instruments (Southgate & Roscigno, 2009). Southgate and Roscigno (2009) claimed that such associations of music and cognition span across time and cultures. For these reasons of the relationship between music and cognition, Horace Mann, a founding thinker of the public education system, saw the importance of including music in the core curriculum of the US school system (Southgate & Roscigno, 2009).

To examine the effect of music on academic achievement, Hailat, Khasawneh, Shargawi, Jawarneh & Al-Shudaifat, (2008) used 4,578, 7th-grade, Social Studies students from 74 schools in Jordan. The experimental group listened to music for three minutes during academic instruction and the control group received traditional instruction without music. Prior to implementation, a pretest was administered to both groups. After three weeks of implementing the intervention, a posttest was administered. Both experimental and control groups were taught by the same instructor in each section. The authors found that the pretest scores were not a predictor of the posttest scores. The group

that listened to music performed much better than the control group in the post intervention test. The authors concluded that listening to music improved academic achievement.

Flood (2007), desiring to examine the effects of Baroque background music on attitude towards nursing research and test results, conducted a study exposing one group of nursing students to background Baroque music before a test and a control group to no music. The results indicated that the experimental group scored higher on the test than the control group. However, a significant attitude change between the control and the experimental groups were not found. Strachan (2015) deduced from these results that not only the type of music, tempo, and volume but also the playing time might have a significant role in academic achievement. Strachan states that perhaps the prior exposure to music before a test "sets the mood for concentration."

If music thus improves mood and learning, then the possibility of negating the adverse effects of weather variables through music in a classroom setting should be examined. Music will possibly be a tool to create an atmosphere conducive to learning to counteract the adverse effects of changing meteorological variables. Therefore, in this study, I examine if using background baroque music on days of rapid weather changes will help the students improve concentration and academic productivity.

## Methodology

To examine what effect background baroque music has on student concentration and work accomplishment on days of rapid weather changes, I used direct teacher observations and student feedback methods of data collection. These observation and feedback tools helped monitor the daily classroom behavior of focus and academic accomplishment of twelve kindergarten and elementary aged, Montessori students. The

students included three kindergartners and nine six-to-nine-year-olds. The study site was a private Montessori school situated in a major Midwestern city. I analyzed the data gathered in this study using Microsoft Excel with frequency distribution and variability methods of descriptive data analyses.

The Montessori work period conducted in this school was as follows: Each child received a workplan (list of academic activities) divided into six categories: Mathematics, Geometry, Language Arts, Biology, Social Studies, and Fine Arts. Each pupil obtained a daily goal to assist in completing these activities. The children had the freedom of choice to select the works (activities) they performed on a given day and time. The morning work period commenced at 8:30 A.M. and ended at 11:45 A.M. After a break for lunch and recess, the afternoon academic work period began at 1:15 P.M. and ended at 3:30 P.M. In addition to educational activities, the Friday schedule contained many Practical Life activities. These life skill activities mostly included watering the plants and cleaning of the classroom to prepare it for the following work week.

The study was conducted over six weeks from Monday through Thursday during the morning academic work period from 8:30 A.M. to 11:30 A.M. Data was not collected on Fridays as the schedule included both academic and non-academic activities. Monday through Thursday of each week, before the children entered the classroom, the regional, hourly and tabular weather forecasts obtained from the National Weather Service's weather station situated at the O'Hare International Airport (ORD) were saved. ORD is less than ten miles away from the school. Weather variables change throughout the day from moment to moment. Sometimes the changes were minimal, ranging from 0-3 degrees or 1-3%. On other days, the fluctuations were much greater and rapid. I noted hourly temperature, dew point, wind chill, surface winds, wind gusts, relative humidity,

precipitation potential, and sky cover between 8:00 A.M. – 12:00 Noon. The hourly barometric pressure of the area measured at ORD was also recorded during these times using an Android application. At the end of the day, I transferred all the data to an excel spreadsheet and calculated the range, mean, median, and the mode of the values of all the weather variables gathered. The rapid meteorological changes were noted. A variability method of descriptive data analysis was used to identify rapid weather changes throughout the morning.

Every other week, before the children entered the room for their morning activities, I played background music streaming from the Sunday Baroque Music radio station between 8:30 A.M. -11:30 A.M. During the alternate weeks, the work period began without the intervention of the background music. After the children entered the classroom and got involved in regular classroom activities, I used the teacher tally chart (see Appendix A) to make notes of behavior, focus, and work of the students as a group through observations during half-hour intervals. This chart was designed to record engagement in the work, purposeful movement, and task-oriented conversations. Other journal notes were also made by the adult to indicate unusual occurrences, disturbances, or special events such as a child's birthday that would affect the children's focus level. An Android application sound meter was also set up in the morning to measure the degree of noise in the environment. At the end of the morning work period, I recorded the minimum, maximum and the average sound levels. The tally chart, teacher notes, and the sound meter helped determine the concentration, engagement, noise level and the accomplishment of work goals with and without the intervention on days of rapid and minimal forecasted weather changes. At the end of the day, the observations of the whole

group focus, movement, distractions, conversations, and noise levels were measured against the hourly times of the rapid weather changes to deduce correlations.

The children completed a feedback form (see Appendix B) to indicate their attitude towards the background music during each work. This music appreciation chart showed the students' feelings about the background music. It identified its helpfulness or distracting quality to their work and indicated whether it created a pleasant atmosphere conducive to learning. This chart required the children to draw a face showing whether they "liked, not liked, or did not pay attention" to the music played. These likes and dislikes were tallied and displayed in a frequency distribution chart. This data helped reveal the effect of music on the class atmosphere as a whole and whether it created a pleasant environment enhancing learning.

The students also filled a second feedback form (see Appendix C) at the end of their work period regarding punctuality, mindset towards the activities performed, concentration levels, and daily work accomplishments. This form indicated the students' perception of their mindset and focus levels by stating; "Today, I liked/focused on… all my work, some of my work, some parts of my work or no work." The daily work accomplishments indicated by the students completed statements such as "My daily goal…1, 2, or 3 works; I completed…1, 2, or 3 works; Incomplete works…0, 1, 2, or 3." The students also indicated the reason for not completing the work and their academic goal for the following day. The finished works were tallied and placed in a frequency distribution chart and compared with days with and without the intervention on days of rapid weather changes.

## Data Analysis

The regional, hourly, weather changes were gathered and saved each morning from the National Weather Service. Background music from the Sunday Baroque Music Radio Station streamed every other week into the classroom. The music was used on weeks I, III and V (the weeks of January 16th, January 30th, and February 13th) between 8:30 A.M. and 11:30 A.M. On the alternate weeks of II, IV and VI, (the weeks of January 23rd, February 6th, and February 20th), the academic schedule began as usual with no background music. The weather changes were noted each day, and the dispersion of each meteorological weather factor examined using the variability method of distribution statistics through range calculations between 8:00 A.M – 12:00 Noon (For an example, see Table D1). Two student feedback forms were used to gather data. The first titled, Student Feedback Form on Background Music (Appendix B) gauged the students' attitude towards the Baroque music. The second titled, Student Focus/Performance Feedback (Appendix C) helped gather information on student mindset towards their work, student focus activity, and academic work accomplished with and without the music. Data were collected Monday through Thursday of each week.

### Student Mindset towards Baroque Music

The attitude towards the Baroque background music measured with a student feedback tool displayed the pupils' likes or dislikes towards the music. This Student Feedback Form on Background Music (see Appendix B) was made available to the students during the morning work period to indicate their attitude towards the music while working or after the completion of each work. A majority of the students failed to fill the form after each work but completed it at the end of the work period of each day. The students' feelings regarding the Baroque music indicated whether they 'loved, liked'

(positive affinity), thought it was ‘ok (neutral affinity), not liked (negative affinity),’ or paid ‘no attention’ (no 19ttn..). The children indicated their appreciation for the intervention by drawing different types of faces on the form (Appendix B). It was interesting to note that some children enjoyed the music during certain types of activities but not others. At the end of each day, the data were transferred to an Excel spreadsheet, organized, and calculated using the frequency distribution method. At the end of each week, the rates of each day and the percentages of each week were tabulated.

Three weeks (Weeks I, III, and V) out of the six including the weeks of January 16th, January 30th, and February 13th, the background music was played in the classroom. During the first week, the students stated that they ‘loved’ or ‘liked’ (positive affinity) the music approximately three-fourths (73%) of the time. The frequency reduced to a little more than half (53%) by the second week and less than half (47%) by the third (Figure 1). These percentages included an increase of those who ‘liked’ the music (12% to 19%) and a decrease of those who ‘loved’ the music (41% to 28%) from Week III to V. The frequency of thinking that the music was ‘ok’ (neutral affinity) gained one-tenth (10%), and the rate of ‘not liking’ the music (negative affinity) increased (4%) by the third week. The number that ceased to pay attention to the music grew over one-tenth (11%) by the third week.

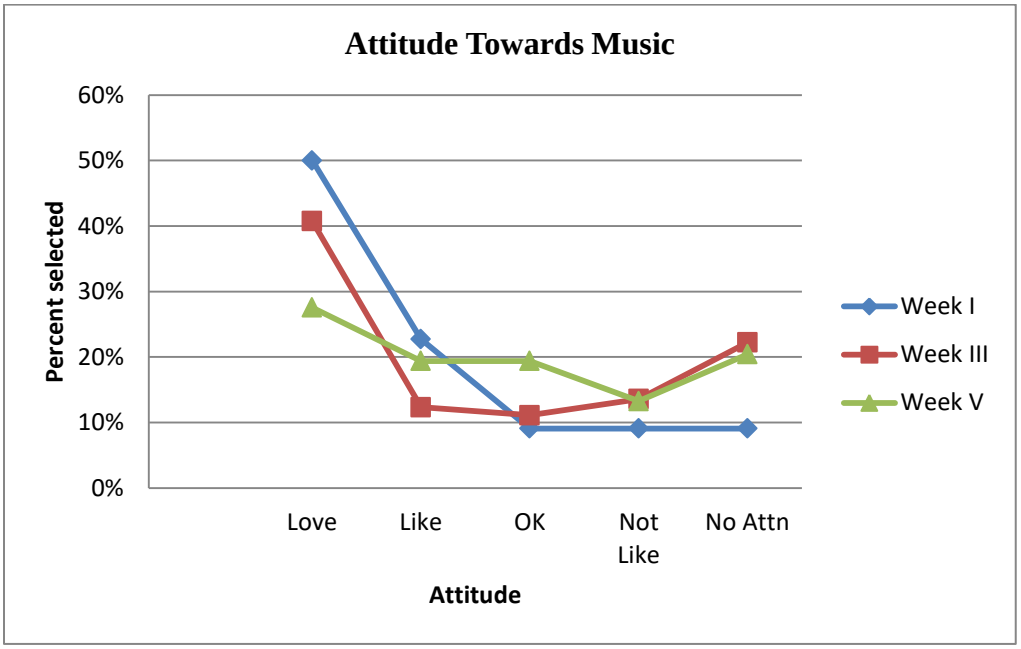



*Figure 1.* The change in attitude of students towards the Baroque music within three weeks

In summary, those who 'loved' the music decreased over time, but those who 'liked' the music increased in frequency. Those who didn't like the music increased and then reduced by a small margin. Those who were neutral towards the music and thought the music to be 'ok,' increased over the three weeks of the intervention. However, overall positive affinity for the Baroque background music by the third week of the study was greater (close to half of all participants) than the negative affinity (a little above one tenth, Figure 2). It will be interesting to observe the continuing trend over time. The increase in neutral affinity changes and no attention changes may indicate that the students are becoming familiar with the music. However, it is unclear whether the music is creating a positive mindset and an atmosphere.

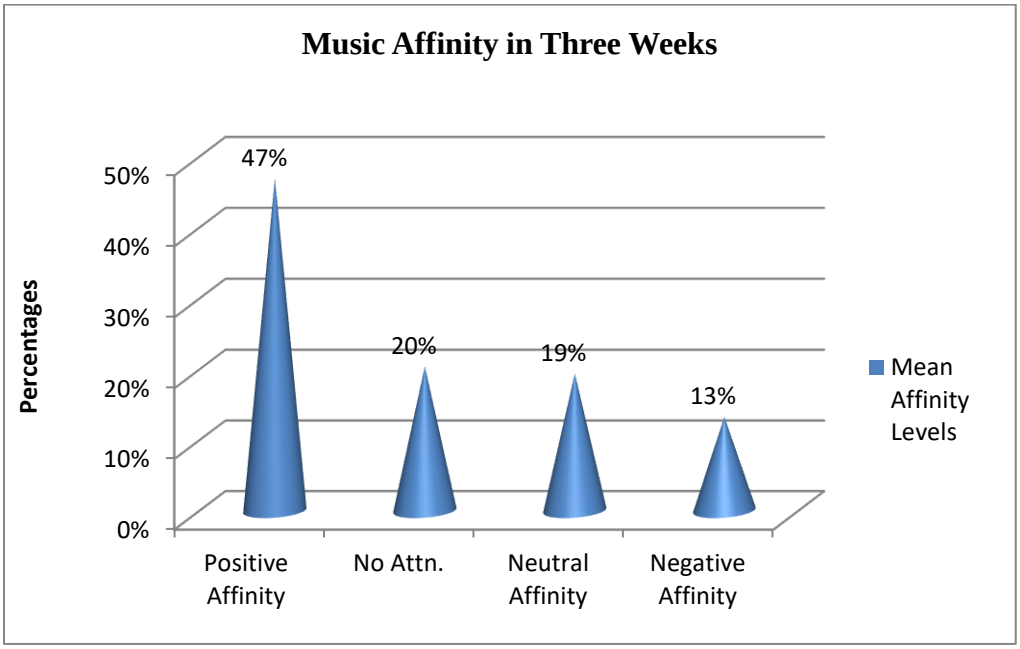



*Figure 2*: Levels of affinity of the group towards the music by week V

**Student Mindset towards Academic Activities**

The second student feedback form titled, Student Focus/Performance Feedback (see Appendix C), helped identify student mindset towards academic work on days with and without the background music. The students identified whether they liked, 'all work, most work, some work, parts of some work,' or 'no work.' This feedback form was completed at the end of the morning work period. Data were transferred to an Excel spreadsheet at the end of each work day. At the end of each week, frequencies and their percentages were calculated using the frequency distribution method. Results were analyzed using a two-sample t-test.

The positive mindset towards 'all work' was higher when the intervention was present than in its absence in the first week. Over the three weeks, the positive attitude towards 'all work' gained (3%) when the music wasn't present, but the positive mindset reduced over one-tenth (11%) during the intervention (Table 1). Similarly, the negative

mindset towards work indicated by, 'like no work,' increased by a tenth (10%) with the music. Without the music, it increased only by a small margin (2%) over time (Table 2). These results may indicate that a positive mindset was enhanced on days without the intervention. However, there was no significant effect of two sample t-test performed on the mindset towards 'all work' $t(4) = 0.34$; $p<0.3$ and 'liking no work' $t(4) = -0.048$; $p<0.4$, with and without the music. These values indicate that the above results could have been due to chance. However, the days of liking 'most work,' totaled less with the music (3%) than without the music (18%). These results show that on the days without the music, a mindset of 'liking most work' was highly significant $t(4) = -3.48$; $p < .01$.

These results that displayed a positive mindset towards 'all work,' that were more apparent on days without the Baroque background music, happened by chance is 0.3 in 1. A negative attitude increased in the presence of the music occurred by chance is 0.4 in 1. The fondness for 'most work' decreased over time when the music was present but increased when it was not present with higher significance. These fluctuations with and without the background music, show that the intervention implemented may have either a negative effect or no effect on the students' mindset towards their academic activities.

Table 1

*Change in attitude towards liking all work*

| Liked All Work | Week I | Week II | Week III |
|---|---|---|---|
| With Music | 91% | 73% | 80% |
| With no Music | 77% | 82% | 80% |

Table 2

*Change in attitude towards liking no work*

| Liked No Work | Week I | Week II | Week III |
|---|---|---|---|
| With Music | 0% | 8% | 10% |
| With no Music | 7% | 3% | 9% |

**Academic Accomplishment**

In the student feedback form (see Appendix C) titled, Student Focus/Performance Feedback, the children indicated the number of works accomplished during the three hour work period in the morning when the intervention was and was not implemented. These numbers were corroborated with the activities recorded in their notebooks by the teacher. The academic works performed were calculated by assigning a value of 1 to each completed work and 0.5 to a half completed work by the end of the morning work period. The work accomplishments of each morning were tabulated on an Excel spreadsheet and using the central tendency method, the mean of work completed by a child per day and week were calculated. The results showed that on days the background music was played, the average work accomplished by each child was greater in frequency than that of the days when the intervention was not used (Figure 3). On days the Baroque music was used, the students averaged 2.28 works per child per day in the morning and 2.12 works without the intervention. These results indicate that the Baroque background music may have helped the students accomplish more academic activities on a day than when the music was not played.

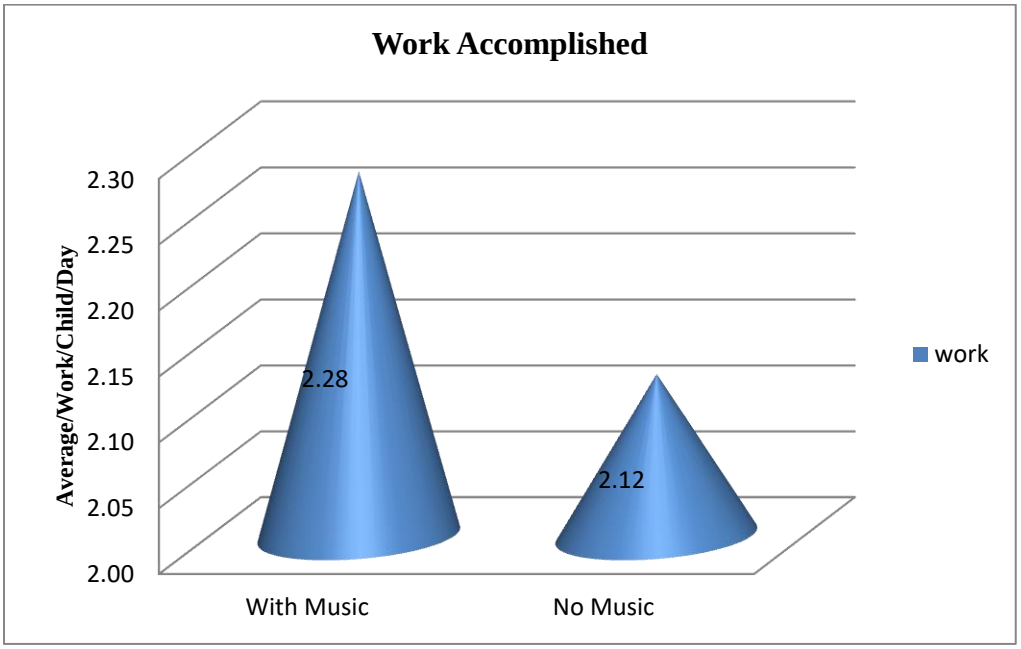



*Figure 3.* Work accomplished per child per day with and without the intervention

**Academic accomplishments and weather variables.** Once the academic accomplishments were tabulated, the rapid meteorological variables were measured against the number of educational activities accomplished by the students as a group. Two-sample t-tests and regression analyses were used to identify the significance of the frequency variations and relationships between the weather variables and the academic accomplishments.

***Barometric pressure.*** The accomplished work amounts were measured against the dispersion of the barometric pressure changes of each week with and without the intervention of the Baroque background music. Three data points of rapid barometric weather ranges common to weeks of both with and without the intervention were plotted (Figure 4). The unit of inches of mercury (inHg) was used for the measurement of pressure. The results indicated that on days of rapid barometric pressure ranges of 0.06 inHg, 0.08 inHg, and 0.09 inHg, the number of works accomplished per child per day

was either close to being equal or higher on the days with the intervention than on days without the intervention (Figure 4). At the observed high range of 0.08 inHg on the days with the background music, the works accomplished rose to an average of 2.89 works per child while on days without the intervention, it decreased to 1.75 works per child during the three hour work period. Regression analysis verified the relationship between barometric pressure and work accomplishment during the intervention with a higher probability (Appendix E, $p<0.06$) than on the days without the intervention (Appendix F, $p<0.5$). This rise in average may indicate that Baroque background music may enhance work accomplishment in the midst of higher barometric pressure changes. However, a longer duration of the study may be necessary to verify this finding.

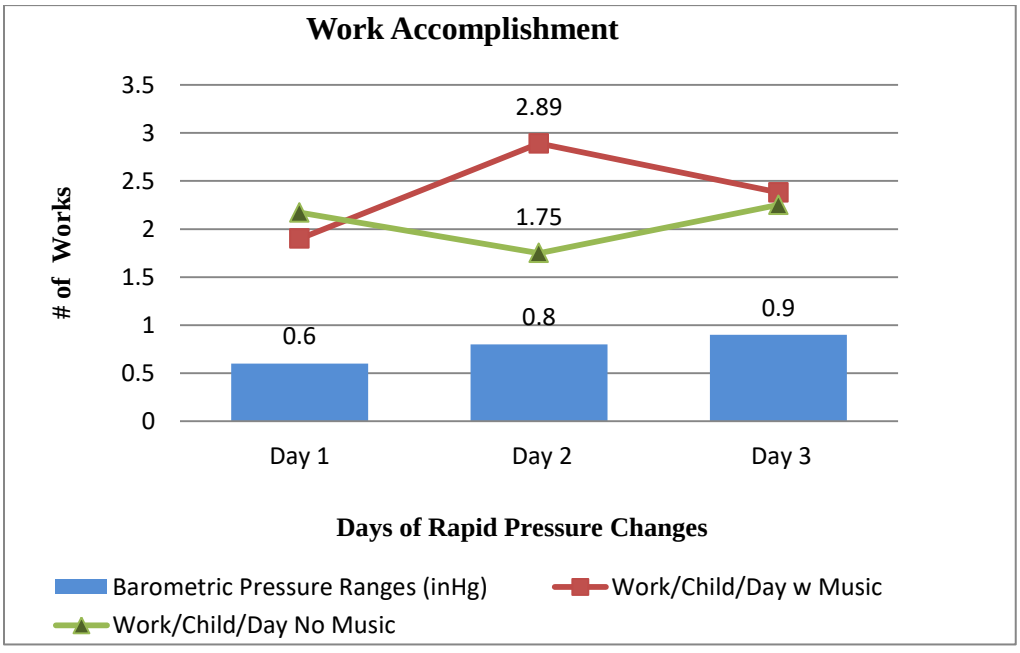



*Figure 4*. Work accomplishment measured against barometric pressure ranges

***Sky cover.*** Average accomplished work per child per week within the three hour morning work period, Monday through Thursday, was also measured against the percent

of sky cover with and without the intervention. Three data points common to both time periods were observed and plotted (Figure 5). Academic accomplishment increased in all three instances. The achievement levels were higher in the days with the background music (Figure 5). In the sky cover range of 7%, the increase in work average per child per week was over half (0.6%) during the intervention. At the other two points of 3% and 11% sky cover, the increases were 2.5 and 1.18 average works respectively. These increases in the works may indicate that Baroque background music may enhance work accomplishment on days of rapid changes in sky cover. Data observed through a longer duration with more common data points may be necessary to confirm this finding.

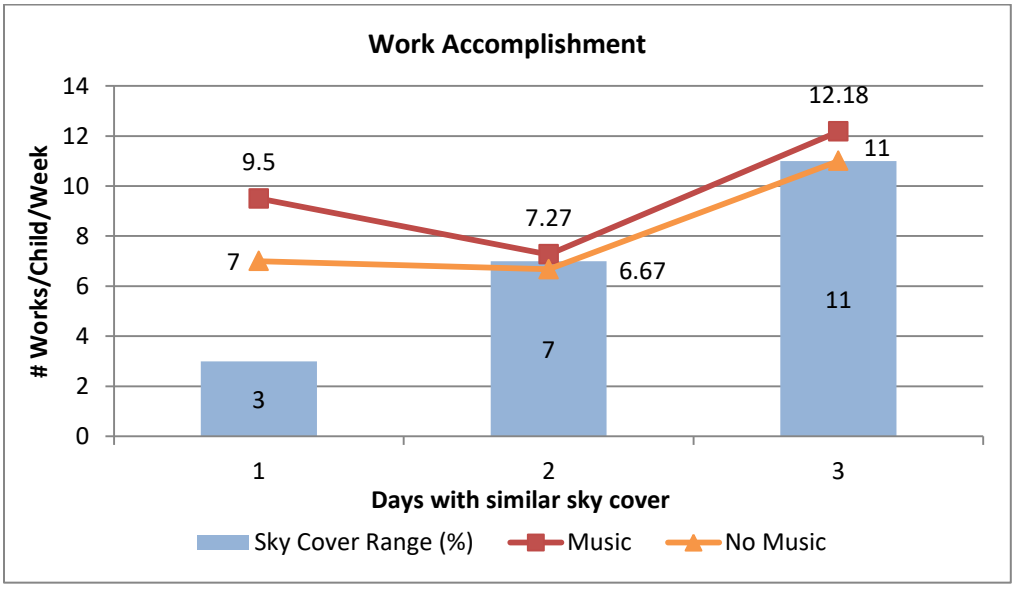



*Figure 5.* Work accomplishment with and without the intervention measured against percent sky cover

***Precipitation potential.*** Similarly, work accomplishment was also measured against precipitation potential. There was only one range of measurement common to both periods with and without the intervention. Therefore, all the rapid precipitation

change measurements in the presence and the absence of the intervention were plotted (Figures 6A & 6B). The joint range of 7% precipitation potential resulted in an 11.75 weekly work average per child during the days of the intervention and an 8.67 weekly work average per child without the intervention. On lower precipitation range days on the weeks with the background music, the students accomplished more work than the days without the music. However, as the changes became more rapid by about 9% precipitation range and above, work accomplishments dropped on the days with the intervention. On the days with no background music, accomplishments of academic activities grew with the rising of the precipitation ranges. However, these relationships do not show validity when subjected to regression analysis (with music: $r^2 = 0.18$, $p<0.2$; without music: $r^2 = 0.02$, $p<0.8$). Observing the one common range of precipitation potential with and without the intervention seemed to suggest that on days the music was used, a higher number of works were completed. However, more commonly recurring range data points and analysis may be necessary to confirm this.

Figure 6A

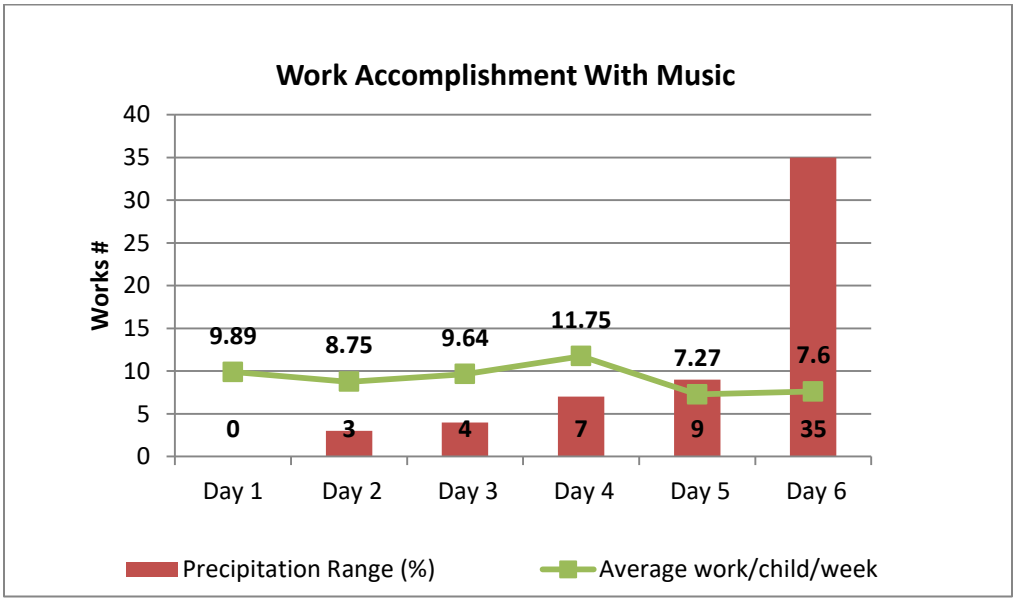
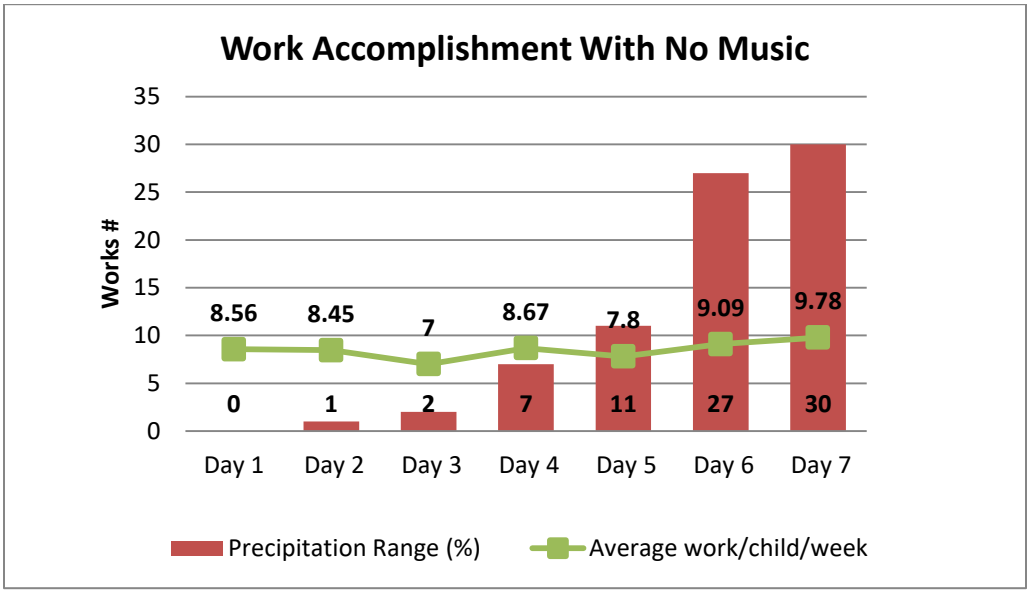


Figure 6B




*Figures 6A & 6B:* Work accomplishment measured against precipitation potential

***Relative Humidity and Temperature.*** Only one equal range point of relative humidity (22%) was observed between the days of rapid changes and academic accomplishment with and without the intervention. With the intervention, 8.75 works per child per week were completed while without the intervention, 8.73 works were accomplished. These results did not indicate a difference. The common ranges (7°F and 13°F) of temperature delivered an academic accomplishment of 8.00 and 9.50 works per child per week with the intervention and 9.09 and 7.00 works per child per week without the intervention. T-test deemed these values non-significant $t(2) = 0.548$; $p < 0.3$.

The plotted graphs between the higher ranges and work accomplishment with and without the Baroque background music indicated a fluctuating pattern on the days of the intervention (Figures 7A & 7B) in comparison to the days without the music.

Figure 7A

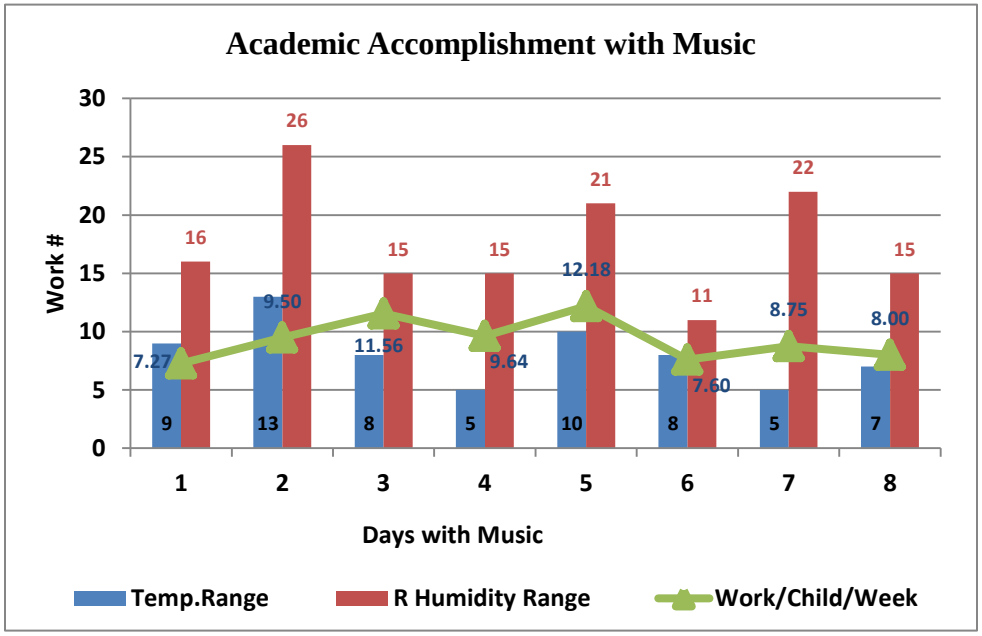



Figure 7B

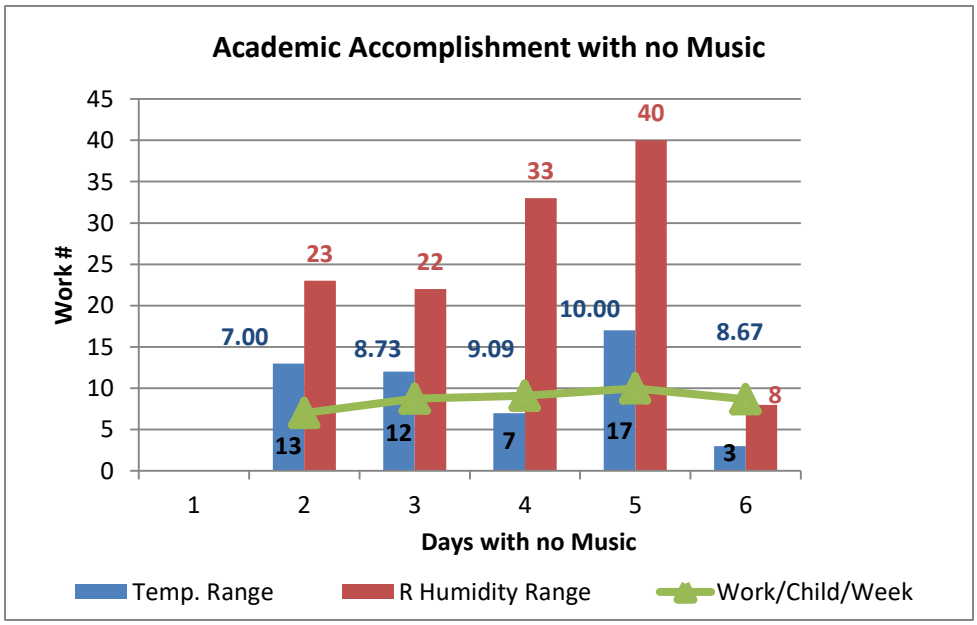



*Figure 7A & 7B*. Work accomplishment measured against temperature (Temp.) & relative I humidity

Regression analysis was conducted to examine the relationship between these weather variables and work accomplishments. Results indicated a higher correlation between the

rapid meteorological changes and the work accomplishment on days of the intervention (Table 3A). Table 3A shows that the variation in the work accomplishment per child per week is accounted for by the variation in the rapid weather changes on days of the intervention ($r^2 = 0.99$, Temperature: $p<0.08$; Relative Humidity: $p<0.12$). Without the intervention, there was a lower degree of the relationship between these variables (Table 3B; r2 = 0.35; Temperature: $p<0.6$; Relative Humidity: $p<0.4$).

Table 3A

Relationship between weather variables and work accomplishment on days with music

Summary Output

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.996832052 |
| R Square | 0.99367414 |
| Adjusted R Square | 0.955718981 |
| Standard Error | 0.377576651 |
| Observations | 8 |

Table 3B

Relationship between temperature, relative humidity, and work accomplishment without music

Summary Output

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.592259 |
| R Square | 0.350771 |
| Adjusted R Square | -0.29846 |
| Standard Error | 1.239728 |
| Observations | 5 |

Overall results between weather variables and work accomplishment indicate that there is a higher degree of significance in the increase of work accomplishment when the Baroque music is present amidst rapid weather changes (Appendix E).

**Concentration**

The Student Focus/Performance Feedback form (Appendix C) was also designed to gather the children's perception of their level of academic focus on days with and without the intervention. The form stated, "Today, I was focused during, 'all work, most work, some work, parts of some work' and 'no work.' This feedback form was completed at the end of the work period, and the data transferred to an Excel spreadsheet at the end

of each work day. At the conclusion of each week, frequencies and their percentages were calculated using the frequency distribution method. Significance between means was determined using two-sample t-tests.

**Concentration and Weather Variables.** When considering the focus levels as a whole, the background music seemingly had no effect on student concentration on classroom activities. Without the intervention, focus on ‘all work’ was slightly higher (2%) than in the presence of the Baroque background music. A two-sample t-test reveals that the differences of focus on ‘all work’ with and without the music were non-significant $t(14) = -0.386$; $p<0.3$. In both instances, an equal number of students (4%) focused on ‘parts of some work.' A slightly greater student proportion (3%) focused on ‘some work’ in the absence of the intervention, which also yielded no significance $t(4) =0.376$; $p<0.3$. There was a higher significant effect for a larger number of students (5%) focused on ‘most work’ in the presence of the background music $t(4) =3.49$, $p <0.01$. The regression analysis indicated that the variation of focusing on ‘most work’ was explained by the weather variables in conjunction with the Baroque music (96%; Table 4A). However, there was no such indication of correlation of focusing on ‘most work’ with no background music (14%; Table 4B).

Table 4A
Relationship between focusing on most work, weather variables, and music

SUMMARY OUTPUT

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.980090127 |
| R Square | 0.960576657 |
| Adjusted R Square | 0.724036599 |
| Standard Error | 6.903469688 |
| Observations | 8 |

Table 4B
Relationship between focusing on most work, weather variables, and music

SUMMARY OUTPUT

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.383419 |
| R Square | 0.14701 |
| Adjusted R Square | -0.70598 |
| Standard Error | 7.384397 |
| Observations | 11 |

Considering ‘all work’ and ‘most work’ together, a higher number of students focused during the presence of both the background music (94%) and in its absence (91%, Figure 8A). Examining the level of concentration on ‘some work’ and ‘parts of some work,’ a lower frequency of students (5%) focused during the intervention, and a slightly higher number (8%) concentrated without the music. According to these results, there were some instances when the background music seemingly enhanced student attention on work, but other results indicated that focus levels were higher without the music. These inconsistencies of the values do not give a clear indication as to the effect of the Baroque background music on student concentration.

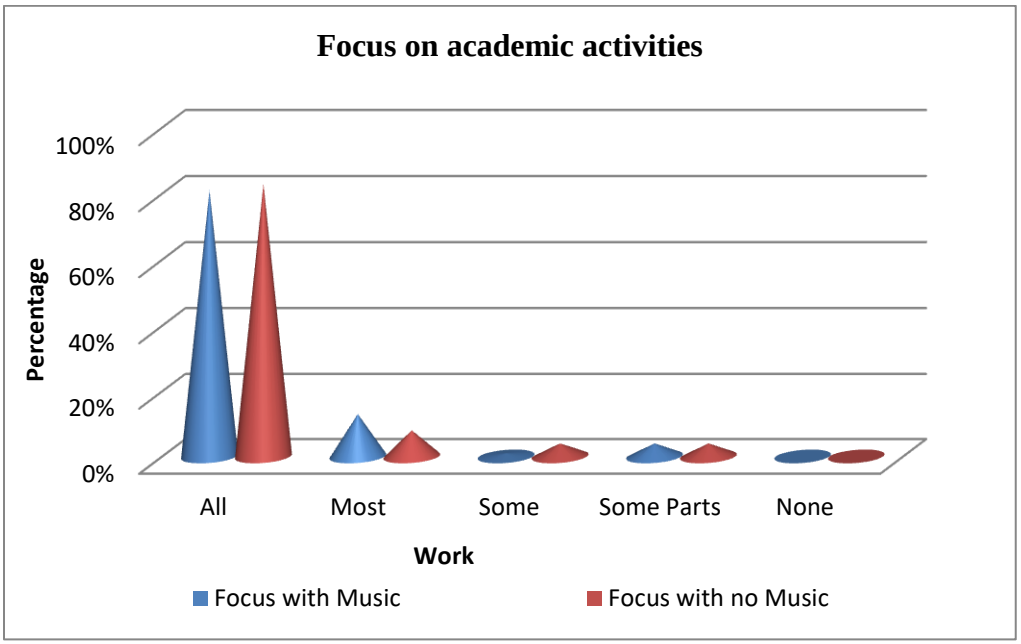



*Figure 8A:* Student focus on academic activities with and without the intervention

However, when considering the progression of the concentration levels over the three weeks, the degree of focus increased (from 50% to 80%, and to 90%) over time (Figure 8B) with the Baroque music. The level of concentration over the three weeks without the intervention grew in the first two weeks (from 80% to 90%) but reduced again (to 80%) in the third week (Figure 8B). This progression of enhanced concentration may indicate that as the students become familiar with the music, it might increase the concentration levels of students.

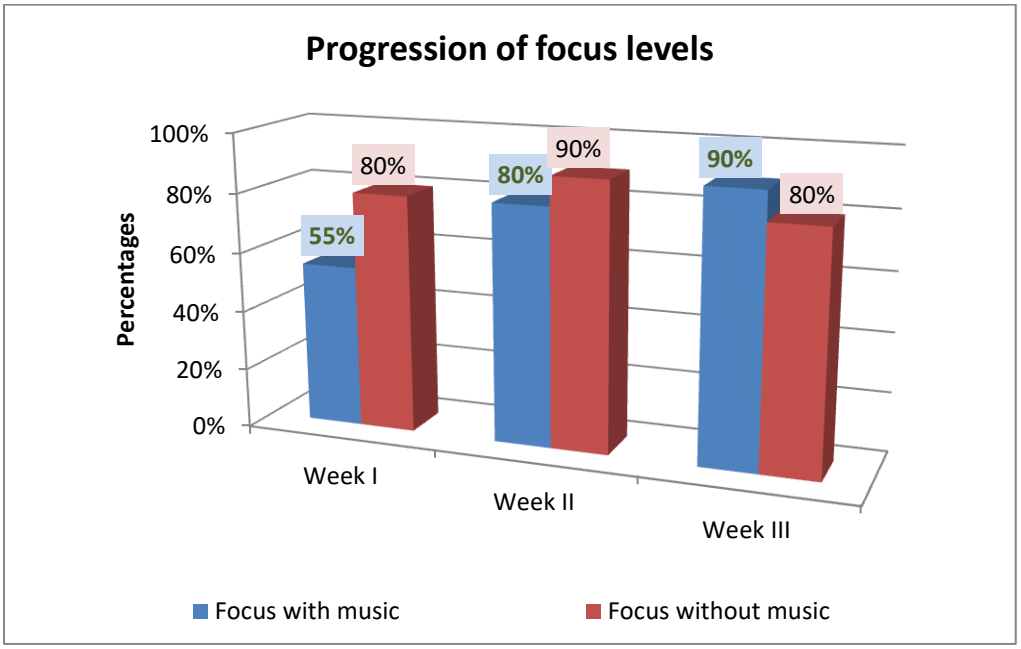



*Figure 8B*: Student progression of focus over time on academic activities with and without the intervention

## Action Plan

Weather is an interesting and unavoidable phenomenon that affects our day to day living. There is empirical evidence to indicate that weather also affects our mood, behavior, and thereby concentration. Concentration is a key ingredient to the success of our students' academic accomplishments. Lack of this component in a student's work day could result in declined scholarly productivity. According to the National Weather Service, weather variables change daily from moment to moment. Therefore, finding methods to mitigate the adverse effects of weather that interfere with children's education is an important task.

Baroque background music was used in the hope of reducing the effects of meteorological variables on students in the elementary classroom. This study looked at using Baroque music as a way to enhance classroom ambiance by creating a happy and

calm atmosphere. Before creating a pleasant environment, it was important to know the feelings the students have towards the intervention. A student feedback form indicating the attitude towards the music was filled in daily by the students. Even though the intention was to gauge the students' attitude to music during each activity, many students only completed the form at the end of the morning work period. This delay might have affected the results if the students had already forgotten the exact feeling they experienced towards the music during the activity.

It was interesting to see how the students loved the music during certain activities but did not during others. Two of my older students who liked the music initially when I played it in December constantly begged me to increase the volume. We listened to the music then, while creating our holiday art projects, and preparing for our International Dinner. In January, I was surprised to see them indicate that they didn't like the music. When questioned why, one ten-year-old answered saying, "I don't like it now because the music doesn't help me concentrate on my work."

The appreciation of music varied from day to day and from work to work. However, over the three weeks, the positive affinity of students for Baroque music had the highest frequency. It also seemed that the students were becoming more familiar with the music and that they were beginning not to pay attention to it but focusing more on the work at hand. It is unclear from the responses, however, whether the music was able to create a positive mindset and a calmer working atmosphere.

Just as Flood (2007) did not find a positive attitude change of her students in the presence of Baroque background music towards nursing research, there was no apparent positive attitude towards the academic activities during the intervention indicated by the results. However, the results showed that a positive mindset towards 'all work' was more

apparent in the days without the Baroque background music. A positive mindset towards 'most work' also was present in the weeks without the intervention. The fluctuations seen with and without the background music may indicate that the intervention implemented may have an adverse effect or no positive change in the students' mindset towards their academic activities.

In spite of these findings, the work accomplishment grew during the implementation of the Baroque music. The music may have helped the students accomplish more educational activities in a day. On days of higher barometric pressure, sky cover, and lower precipitation potential changes, the music contributed to raising the work accomplishment of students with the music. However, as the precipitation potential ranges increased above 9%, the trend changed and the number of works reduced. I am unsure of the reason for this occurrence. A larger number of common range points are necessary to confirm this. On the whole, a higher significance between work accomplishments and weather variables are observed on the days using the Baroque music.

The results of background music on student concentration are inconclusive due to the inconsistencies that were observed, however, over time, student focus seemed to increase with the intervention. The results also showed that on days with the intervention; focus on 'most work' improved. These results indicate that Baroque background music may be a useful tool to utilize in mitigating some of the adverse effects of hourly weather variables. However, a longer duration of study is necessary to confirm these findings.

Even though I used a sound gauge in the classroom, I did not include the results here for many reasons as I did not think that the results were valid. There were days I missed using the sound gauge for various reasons such as losing battery power. There

were other days when noises other than the daily sounds of the children were recorded, i.e. dropping of a material or outside noise. Initially, my sound recordings were faulty as the students kept coming up to the gauge and making noise purposely just to see the indicator move. For these reasons and many others, I did not include the results of the sound recordings. In the future, I have decided to place the sound meter in an inconspicuous place and to gather the noise levels of the children and examine the relationship it has to rapid weather changes.

I would like to repeat this action research for a longer duration to confirm these results. After that, I would like to explore other genres of music to search for the best type of music to use to enhance concentration, ambiance, and work accomplishment to mitigate the effects of weather variables. I would also like to examine changes in noise levels in the classroom due to weather changes. As a practice, I will continue to use background music in my classroom. As the results clearly showed, it will help negate some of the adverse aspects of meteorological variables and increase the work accomplishment of my students. Increasing work accomplishment may lead to fulfilling goals which may, in turn, help my students grow in their potential for success and greater self-assurance.

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Appendix A

## TEACHER TALLY CHART: WEATHER/FOCUS

| **Teacher Name:** | **Date:** | **Time Period:** |
|---|---|---|
| **Music:** | Yes | No |
| **Meteorological Changes Gathered From 8:00 AM – 12:00 Noon** | | |

| **Behavior** | | **8:30-9:00 AM** | **9:00-9:30 AM** | **9:30-10:00 AM** | **10:00-10:30 AM** | **10:30-11:00 AM** | **11:00-11:30 AM** |
|---|---|---|---|---|---|---|---|
| Totally Engaged in task | | | | | | | |
| Focused but not totally engaged | | | | | | | |
| Looking around | | | | | | | |
| Talking to neighbor: Related to task | | | | | | | |
| Talking to neighbor: Unrelated to task | | | | | | | |
| Purposeful movement | | | | | | | |
| Movement not purposeful | | | | | | | |
| Happy demeanor | | | | | | | |
| Unhappy demeanor | | | | | | | |
| Noise Level | Lowest | | | | | | |
| | Average | | | | | | |
| | Highest | | | | | | |
| Today was Unusual because… | | | | | | | |

Appendix B

**Student Feedback Form on Background Music**

Name: _____

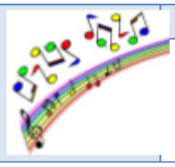
Show below how you felt about the music by drawing the appropriate face:

| I liked the music very much! | I liked the music a little. | The music was Ok. | I did not like the music! | I did not pay attention to the music |
|---|---|---|---|---|
|  |  |  |  |  |

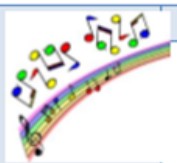
Date: _____

| | 1st Work | 2nd Work | 3rd Work | 4th Work |
|---|---|---|---|---|
|  | | | | |

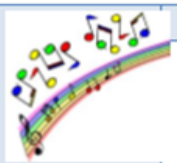
Date: _____

| | 1st Work | 2nd Work | 3rd Work | 4th Work |
|---|---|---|---|---|
|  | | | | |

Date: _____

| | 1st Work | 2nd Work | 3rd Work | 4th Work |
|---|---|---|---|---|
|  | | | | |

Date: _____

| | 1st Work | 2nd Work | 3rd Work | 4th Work |
|---|---|---|---|---|
|  | | | | |

Appendix C

## Student Focus/Performance Feedback

| Student Information | | | | | |
|---|---|---|---|---|---|
| Name | | Time Period | | | |
| Date | | Music | | Yes | No |

| Student Feedback | | | | | |
|---|---|---|---|---|---|
| **Punctuality** | **Before 7:00 AM** | **7:00-7:30 AM** | **7:30-8:00 AM** | **8:00-8:30 AM** | **Tardy** |
| Today, I came to school | ☐ | ☐ | ☐ | ☐ | ☐ |
| *Comment* | | | | | |
| **Mindset** | **All Work [5]** | **Most Work [4]** | **Some Work [3]** | **Parts of Some Work [2]** | **No Work [1]** |
| Today I liked | ☐ | ☐ | ☐ | ☐ | ☐ |
| *Comment* | | | | | |
| **Focus [Activity]** | **All Work [5]** | **Most Work [4]** | **Some Work [3]** | **Parts of Some Work [2]** | **No Work [1]** |
| Today I was focused during ... | ☐ | ☐ | ☐ | ☐ | ☐ |
| *Comment* | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| **Academic Goals** | **0 Works** | **1 Work** | **2 Works** | **3 Works** | **4 Works** |
| My daily goals | ☐ | ☐ | ☐ | ☐ | ☐ |
| I completed | ☐ | ☐ | ☐ | ☐ | ☐ |
| Incomplete | ☐ | ☐ | ☐ | ☐ | ☐ |
| *I couldn't complete my work because* | | | | | |
| *My goals for tomorrow* | | | | | |

# Appendix D

## Table D1

*An example of the regional, hourly tabular weather variables gathered from the National Weather Service*

| **Date** | **6-Feb** | Weather | | | | |
|---|---|---|---|---|---|---|
| **Hour (CST)** | **8** | **9** | **10** | **11** | **12** | **Range** |
| Temperature (°F) | **30** | **31** | **35** | **39** | **43** | **13** |
| Dewpoint (°F) | **27** | **27** | **28** | **30** | **32** | **5** |
| Wind Chill (°F) | **24** | **25** | **30** | **34** | **38** | **14** |
| Surface Wind (mph) | **6** | **6** | **6** | **7** | **8** | **2** |
| Wind Dir | S | S | S | S | S | |
| Gust | | | | | | |
| Sky Cover (%) | **49** | **48** | **49** | **50** | **51** | **3** |
| Precipitation Potential (%) | **0** | **0** | **0** | **0** | **2** | **2** |
| Relative Humidity (%) | **88** | **85** | **75** | **70** | **65** | **23** |
| Rain | -- | -- | -- | -- | -- | |
| Thunder | -- | -- | -- | -- | -- | |
| Barometric Pressure | 29.88 | 29.88 | 29.85 | 29.83 | 29.8 | 0.08 |

# Appendix E

## Relationship between Work Accomplishment and Weather with Music

SUMMARY OUTPUT

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.996832052 |
| R Square | 0.99367414 |
| Adjusted R Square | 0.955718981 |
| Standard Error | 0.377576651 |
| Observations | 8 |

ANOVA

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 6 | 22.3941548 | 3.732359133 | 26.18021242 | 0.148500922 |
| Residual | 1 | 0.142564127 | 0.142564127 | | |
| Total | 7 | 22.53671893 | | | |

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* | *Lower 95.0%* | *Upper 95.0%* |
|---|---|---|---|---|---|---|---|---|
| Intercept | 20.01398542 | 1.50189585 | 13.32581445 | 0.047684049 | 0.930589257 | 39.09738 | 0.930589 | 39.09738 |
| T | 0.880180281 | 0.112250916 | 7.84118572 | 0.080753306 | -0.546102842 | 2.306463 | -0.5461 | 2.306463 |
| WC | -1.3743523 | 0.138407558 | -9.92974914 | 0.063896939 | -3.132987092 | 0.384282 | -3.13299 | 0.384282 |
| SC | -0.21765891 | 0.034618918 | -6.28728240 | 0.100414061 | -0.657533977 | 0.222216 | -0.65753 | 0.222216 |
| P | -0.02675723 | 0.027228691 | -0.98268548 | 0.505559371 | -0.372730561 | 0.319216 | -0.37273 | 0.319216 |
| RH | -0.31873923 | 0.064466056 | -4.944295539 | 0.127044628 | -1.137858135 | 0.50038 | -1.13786 | 0.50038 |
| BP | 0.682714841 | 0.073291836 | 9.315018991 | 0.068082621 | -0.248546228 | 1.613976 | -0.24855 | 1.613976 |

RESIDUAL OUTPUT

| *Observation* | *Predicted WK* | *Residuals* |
|---|---|---|
| 1 | 7.327829403 | -0.05510213 |
| 2 | 9.419633282 | 0.080366718 |
| 3 | 11.69704365 | -0.141488098 |
| 4 | 9.342540636 | 0.293823 |
| 5 | 12.15569452 | 0.026123659 |
| 6 | 7.58002207 | 0.01997793 |
| 7 | 8.879394571 | -0.129394571 |
| 8 | 8.094306509 | -0.094306509 |

# Appendix F

## Relationship Between Work Accomplishment, Temperature, and Relative Humidity with No Music

SUMMARY OUTPUT

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.592259297 |
| R Square | 0.350771075 |
| Adjusted R Square | -0.29845785 |
| Standard Error | 1.239728105 |
| Observations | 5 |

ANOVA

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 2 | 1.660767 | 0.830384 | 0.540288736 | 0.649228925 |
| Residual | 2 | 3.073852 | 1.536926 | | |
| Total | 4 | 4.734619 | | | |

| | *Coefficients* | *Standard Error* | *tStat* | *P-value* | *Lower 95%* | *Upper 95%* | *Lower 95.0%* | *Upper 95.0%* |
|---|---|---|---|---|---|---|---|---|
| Intercept | 7.779068703 | 1.451766 | 5.35835 | 0.033108744 | 1.532625455 | 14.02551 | 1.532625 | 14.02551195 |
| T | -0.088852281 | 0.160544 | -0.55345 | 0.635567125 | -0.77961538 | 0.601911 | -0.77962 | 0.601910819 |
| RH | 0.073093838 | 0.072113 | 1.013608 | 0.417447523 | -0.237181326 | 0.383369 | -0.23718 | 0.383369002 |

RESIDUAL OUTPUT

| *Observation* | *Predicted WK* | *Residuals* |
|---|---|---|
| 1 | 8.305147324 | -1.30515 |
| 2 | 8.320905767 | 0.406367 |
| 3 | 9.569199385 | -0.47829 |
| 4 | 9.192333444 | 0.807667 |
| 5 | 8.097262564 | 0.569404 |