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The Preschool Child's Knowledge of Musical Pitch

Farol Ann Nelson

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THE PRESCHOOL CHILD'S KNOWLEDGE
OF MUSICAL PITCH

by

Farol Ann Groutage Nelson

A thesis submitted in partial fulfillment of the requirements for the degree of
MASTER OF SCIENCE
in
Family and Human Development
ACKNOWLEDGMENTS

I would like to express my appreciation first of all to my father, without whom I would never have seen the end of this project. I am grateful for the love and concern he exhibited for me throughout the months, and for his final determined push which enabled me to finish my degree.

Thanks go to my committee for all the encouragement and advice they offered me during my years at Utah State. I especially appreciated the criticisms and the patience that was so necessary during the research and writing of this paper.

Last, I thank my husband, Eric, for his musical knowledge, suggestions and support that he shared so willingly until all was completed.

Farol Ann Groutage Nelson
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ABSTRACT

The Preschool Child's Knowledge of Musical Pitch

by

Farol Ann Groutage Nelson, Master of Science

Utah State University, 1976

Major Professor: Dr. Carroll C. Lambert
Department: Family and Human Development

The objective of this study was to determine what kinds of musical instruments were most effective in developing pitch discrimination in preschool children. Five melody instruments were used in this study, including a wooden soprano recorder, a C flute, a commercially made xylophone, a melodica, and a set of cut conduit pipes played as a xylophone-type instrument. Children from the Child Development Labs at Utah State University, Logan, Utah comprised the sample.

It was found that children do identify high and low pitches more easily in some instruments than in others. They discriminated between high and low pitches of the wooden soprano recorder more accurately than was true of any of the other four instruments, and were least accurate in their response to the xylophone. There were no significant differences between responses of boys and girls.
It was also found that the child had to possess a directional knowledge of high and low before he could identify high and low pitch.

It was concluded that the recorder was a more effective instrument in teaching children to discriminate between high and low pitches than any of the other four instruments tested.
INTRODUCTION

Music in a child's education and in his life has long been of interest to parents and educators. Through the years, musicians, teachers, and philosophers have not hesitated to expound upon the musical capacities of the student. The professionals have also been prolific in their comments concerning the student's development and enjoyment of these capacities.

According to Seashore (1938) the musical capacities persons possess include a sense of tone, rhythm, volume, and consonance. These, he claims, are largely present at birth. These areas can be developed to some extent throughout the child's life but, just as vision depends on the structure of the eye, pitch acuity depends on the structure of the ear. If the basic structure of the organ is not satisfactory to begin with, it is difficult to cure the situation. The child's sense of pitch is considered to be included among his inherent musical capacities. Being able to identify high and low sounds and to discriminate between them is important to the child's musical development.

Runkle and Eriksen (1966) state that the child who cannot distinguish the high and low direction in music merely has less in the way of auditory discrimination abilities. This child must have extra training and attention or he may easily become one who "cannot carry a tune in a bucket" or more accurately, a non-singer.
Many instruments and devices are used in the schools to provide the child with a satisfactory musical experience. The young child is exposed mainly to rhythm type instruments: drums, tamborines, triangles, maracas, bells and cymbals are among some of them.

In order to enrich the young child's musical experiences, he needs to hear a variety of instruments, not just the rhythm band or the piano. There are several simple, easy to play instruments that are just as exciting and satisfying to the teacher and the child.

Several authors, including Runkle and Eriksen (1966), Hickok and Smith (1974), and Greenberg and MacGregor (1972), have noted that the best way to teach a child simple pitches, simple melodies, and give him a rewarding experience is with a simple, uncomplicated instrument; an instrument that can be easily played by the teacher and that produces clear, pure tones that the child has no trouble hearing or discriminating between high and low. In this sense, pure tones are defined as those having as simple an overtone structure as possible.

This study has attempted to examine children's responses and their ability to hear high and low pitches as they are played on the instruments.

Statement of problem

This investigation will attempt to study the child's knowledge of extreme high and low pitches, using five different instruments, four of which may be commonly found and used in a school setting. They are: a set of cut conduit pipes, arranged to resemble a xylophone; a commercially made,
small xylophone; a soprano recorder; and a melodica. A flute, which requires a more experienced performer, will also be used.

First, the child will demonstrate to the author his knowledge of directional high and low by moving up or down on a set of stairs. He will also respond to the high and low pitches of the various instruments by verbalizing his response to the author and by moving to a high or low position on the stairs.

**Purpose**

There is very little empirical evidence indicating the young child's musical abilities. Therefore, the purpose of this study is to determine from which instrument the child can discriminate pitch differences most easily. If the child responds more accurately to one instrument than another, then it would appear that the use of this instrument would be more effective in teaching.

**Hypothesis**

Children recognize high and low pitches in some instruments more readily than in others.
The literature reviewed here will be concerned with three major areas: the child's cognitive development, the child's musical development, and some background on various instruments that can be used in the classroom. Included in the section on cognitive development will be ideas concerning how children learn and effective methods of teaching children new concepts.

The child's musical development will make up the second section. This portion will offer insight on the musical capacities of young children, how they acquire these capacities, and what kinds of environmental factors foster musical development in children.

The third section will deal with various instruments commonly used in the classroom. Positive and negative properties of the instrument will be discussed, as well as their value and practicality for classroom use.

Cognitive development

As more emphasis is being placed on the young child, and more and more preschool programs are being initiated for his benefit, educators and teachers are becoming increasingly aware of children's abilities and capacities for learning. Pines (1967) reiterates from Benjamin Bloom that a child gains as much intelligence in the first four years of his life as he will in the next thirteen. From this statement it may be assumed that the most crucial period in a child's cognitive development is his early years.
Jean Piaget, one of the foremost authorities on child psychology and theory, outlines the stages a child goes through in achieving maximum intellectual reasoning. A brief explanation of the four stages is taken from Furth (1970) and is listed as follows:

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The children with which this study is concerned, and to which the author refers as young children, according to Piaget, are from the ages of four and five, and are in the preoperational stage of development. In this particular stage, a child is forming concepts and ideas upon which he will base much of his subsequent thinking.

Wann, Dorn, and Liddle (1962) have stated that concept development is a very gradual process. A concept is a generalized idea or understanding which grows from many experiences that the child has. It becomes a framework into which he fits his new experiences and new information. Previously learned concepts constitute a stable base for the understanding of new information.

Taken from Piaget's theories, Wann, Dorn, and Liddle explain that the child operates and thinks in an animistic world; that is, he uses magic and
imagination to answer his questions or explain phenomena that he observes and does not understand. Animism is a definite characteristic of young children's interpretations of things around them. Because of this characteristic in the child's rationale, he has a difficult time separating reality from fantasy.

Concrete, firsthand experiences are the most valuable to the child's cognitive development in the preoperational stage as Wann, Dorn, and Liddle explain. The child knows his world as here and now and needs to proceed in his development of new concepts from a definite point of reference—-from the familiar to the unknown.

Children employ the use of all five senses in their ongoing development. Piaget demonstrated that it is a waste of time to tell a child things that he cannot experience through his senses. He stressed that children cannot learn concepts taught merely verbally, but that teachers need to use methods founded on activity and movement (Phillips, 1969).

A child's intellectual development passes through "critical stages" according to Elkind (1971) and Hymes (1968). During these stages a child is especially sensitive to environmental influences. He can gather a great deal of information both beneficial and harmful from the world he is associated with.

Hunt (1964) and Kohlberg (1968) stress the importance of interaction between the organism and its environment, both aspects being equally important. Concept learning occurs through stimulations from the environment, the child's response, and reinforcement of that response.
Musical development

Empirical evidence that surrounds the young child's musical development is quite sparse when compared to the emphasis that is placed upon the older child and his musical development. The studies that have been done with the younger child deal mainly with his vocal development, singing abilities, and attempts to assess his overall musical achievement.

Whereas Carl H. Seashore (1938) devised a number of tests to assess musical ability which he felt was inherent from birth, tests which were designed for persons older than twelve years of age, McGinnis (1928) took ideas from Seashore's tests and applied them to children of preschool age. The results of this study indicated many difficulties including the child's inability to understand the terms high, low, weak, strong, better, and worse. The material was uninteresting, and no conclusive findings were observed because of the erratic responses of the children.

Vance and Grandprey (1931) made an additional attempt in revising Seashore's musical aptitude tests to fit the young child. Tasks in the assessment included imitating rhythms, imitating vocalizations, and keeping time to musical selections.

The conclusions drawn from this effort indicated that any musical aptitude test for the young child must be concrete and on his level of understanding, and must be of very high interest to the child in order to hold his attention. It was also speculated that if a child was too young, the test merely measured maturational patterns and not musical aptitude.
Jersild and Bienstock (1931) studied the influences of vocal training with three-year-olds. They concluded that the children's natural voices were lower in pitch than the majority of songs being used in the songbooks for this age of child. It was also found that the young child has greater flexibility in the range of his voice than was supposed.

Hattwick (1934) also worked with voice range of nursery school age children. The conclusions were much the same in that the children, when given an opportunity to begin a song, chose a comfortable pitch for their voice which was consistently lower than those in the songbooks, and lower than the pitches chosen by the teachers.

Based on the child's developmental pattern starting with the simple and gradually progressing into the complex, Hissen (1953) worked to develop an approach to music that would prove to be more simple for the child. The basic aspects of music, tone and rhythm, were used as the core of the training program. Activities included tone matching, pitch discrimination, rhythm discrimination, and rhythm matching. The child's singing abilities were dependent upon the accuracy with which he distinguished tone and the control he gained in producing tone. Through these activities it was found that the child's ability to sing on pitch improved noticeably.

One study found by the author, using instruments with preschoolers, was written by Colby (1935). He was unsuccessful in teaching the children to play a six-holed fife, and he felt his efforts would have been more meaningful had he worked with the child's natural singing response.
As was mentioned previously by Seashore (1938), a child possesses at birth all the sensory capacities and musical potential that he can ever have. Training and instruction simply magnify and sharpen these abilities. Apparently pitch discrimination does not vary with intelligence or age. Tests done by Stanton (1936) show that there is little difference between adults and children when working with pitch discrimination. The problem that occurs is one of understanding. Children lack the verbal labeling ability to respond to test questions.

Hissen (1953) brings out the point that the young children do not have enough experience with pure tone. Much of what the child hears each day is in the form of complex noise--too complex to be regarded as tone. In teaching the child pitch discrimination it is advisable to use instruments that produce tones with simple structure, those with fewer overtones.

Nye and Nye (1970), in teaching high and low pitch to young children, emphasized the use of the child's whole body to reinforce the concept.

... high and low in pitch are abstractions, the association of high and low pitch with high and low physical levels is artificial, however necessary for understanding. To make these experiences concrete for children it is essential that they be made 'real' in terms of high and low physical position... (Nye and Nye, 1970, p. 270)

The environment in which a child grows and develops plays a large part not only in his intellectual development but in his musical development also. Nye and Nye (1970) have pointed out that the child is bombarded by many types of media, sound, recording, and performances. This exposure can be very advantageous to the child, if adults are understanding of the music around him and help the child develop a sensitive, discriminating ear. All the sounds
a child is exposed to can help increase his attention span and interest in music. Nye and Nye explain that a child maintains interest, reacts more positively, and enjoys musical experiences more if he has plenty of exposure and positive reinforcement at home. Involvement, enthusiasm, and concern between parent, child, and teacher are important aspects in a child's musical development and enjoyment.

Musical instruments

There are many instruments that are on the market suitable for classroom use. The instruments available may be classified into three different categories: rhythm instruments, melody instruments, and harmony instruments. Many of these instruments can belong to more than one category. An instrument can be a melody type and still be used to establish a rhythm. A harmony instrument may be used to play a melody and also keep a rhythm. These relationships will be explained more fully at a later point in this section.

The rhythm instruments are those used to keep a rhythm or to establish a beat in the music. Instruments of this type are commonly found in classrooms of younger children, since they are easily played and help establish the basic musical concept of rhythm. Members of this group, to name a few, include maracas, drum, triangles, tamborines, claves, cymbals, rhythm sticks, shakers, sandblocks, and castanets. The rhythm instruments, according to Hickok and Smith (1974) and Greenberg and MacGregor (1972), serve to enhance the child's development of rhythmic capacities. They highlight the beat of music, change its mood and provide materials on which the
child can experiment in creating his own rhythms. These instruments can also produce different tones; though not musical type tones, the timbre or quality serves to add interest and color to the child's activity, whether he is singing or accompanying a musical selection.

As Hickok and Smith (1974) bring out, care must be taken when purchasing rhythm or percussive type instruments. The quality of sound and durability should not be sacrificed for a cheaper price.

The next group of instruments to be discussed are members of the melody type. Included are those upon which a single note melody line can be played; recorders, bells, flutophones, and members of the more complex woodwind family are included here. It should be mentioned here that in this group of instruments are found the flute and recorder, which as found in Backus (1969) are known to have the purest tones of all the instruments, be they melody, harmony, or rhythm type.

Greenberg and MacGregor (1972) and Nye and Nye (1970) report a general feeling that the melody instruments are the most effective in teaching the child the melodic line or tune of a song, especially if the teacher is unsure of her own melody instrument, her voice. The starting pitch of a song can easily be selected by playing a melody instrument. Also these types are essential for the child's exploration of scales and composing of simple melodies.

Runkle and Eriksen (1966) also state that the melody instruments are the most efficient in teaching the concept of high and low pitch to children, especially those such as the xylophone and tuned glasses which offer visual as well as auditory cues.
The melody instruments can also be used as rhythm type instruments if one single pitch is played as a steady, rhythmical beat.

The last category of instruments is classified as the harmony, or chord, instruments. Members of this family include the guitar, piano, autoharp, melodica, ukulele and banjo. Most of these instruments also fit into the first two categories of rhythm and melody. If one is well trained, a fine melody line can be played, or a steady rhythm kept, on any of these instruments. The primary purpose of the harmony instrument is to enhance the melody line. With this in mind, one must be careful to teach the children the melody of the song before using an accompanying instrument as Hickok and Smith (1970) state. When the child has become proficient with the melody of a selection, the harmony type instrument can prove to add a great deal to the color and mood of the selection.

As stated in Nye and Nye (1970) a teacher can become greatly dependent upon one of these accompanying instruments and lose sight of the child's needs and musical development.

One of the most common of the harmony instruments, and one which the author feels is greatly misused, is the piano. Many classrooms are equipped with a piano. According to Nye and Nye (1970), Hickok and Smith (1970), and Greenberg and MacGregor (1972), this may not be the most satisfying instrument to use with the child. A piano, to be of musical value, must be kept well in tune at all times. This is essential for the development of the child's pitch discrimination, but unfortunately the maintenance of the piano is often overlooked. Also, this instrument could be very limiting to the
teacher. She must remain stationary and has no opportunity to move with the children as they respond to the music they hear. She has very little eye contact with them, especially if she is not particularly comfortable with the instrument and has to rely on the music in front of her. A teacher must be very prepared to use the piano in such a way that she and the child will benefit.

In spite of these disadvantages the piano can be effective if used properly. It is a very effective instrument for exploration, improvisation, and accompaniment if used with discretion and after the child is well acquainted with the songs he sings.

In addition to the above groups of instruments, a good music program according to Greenberg and MacGregor (1972) and Hickok and Smith (1974) should include a record player and quality recordings or a good cassette recorder and tapes. Also, the child's own instrument, his voice, is essential to use constantly in development of his musical capacities.

Just as Nye and Nye (1970) state, the child is inquisitive about his environment and should be exposed to a variety of materials, instruments, and media with which he can experiment and create. He should be provided with those experiences that challenge his imagination and develop the creativity that he possesses.
METHODS AND PROCEDURES

Sample

Prior to selection of the sample, a pilot study was conducted. Two groups of children were used in this exploratory test. One group was composed of younger children, approximately three to five years in age. Because of difficulties in working with this age group in the pilot study, it was decided to limit the sample for the study to children who were sufficiently mature and able to respond effectively in the testing situation. Consequently, the sample was limited to children between the age of four and five years.

The children were selected from among those in attendance at the Child Development Laboratory at Utah State University. Thirty-five children were included, of whom 18 were boys and 17 were girls. There were four groups of children in the Laboratory. One of these groups, which was operating under the direction of the author, was used as part of the pilot study. The procedure for selecting the children from among the other three groups included an initial designation of children between four and five years of age. All children from this age group in three of the four laboratory groups were included in the study.

In summary, it may be noted that the children in the sample were between the ages of four and five years; each had been a participant in the laboratory program for at least one and not more than two quarters; and they came from among those families in which the parents had made application for
them to be enrolled in the Child Development Laboratory. In a general way it is possible to describe them as having come from middle to upper class white families within a 30-mile radius of the University.

Instruments

The materials used in the testing sessions included five musical instruments and one set of wooden, portable stairs which consisted of three steps, a lowest, a middle and a highest.

The musical instruments used were categorized as melody instruments, or those upon which a melody line could be played, note by note. No chord type instruments such as an autoharp or a guitar were used.

The first instrument used consisted of round conduit pipe, about 1 inch in diameter and cut to varying lengths to produce varying pitches when struck with a hard mallet. The pipes were movably arranged on a wooden frame, to be set on a table or the floor when played, in order from longest to shortest (lowest to highest). This instrument resembled a xylophone in construction and will be referred to as the "pipes." Its musical range started from B below Middle C and continued diatonically to two octaves above.

The second musical instrument that was played was the C flute which is the most common of the flute family and has a range of three octaves or 37 notes, starting from Middle C and ending on C three octaves above.

The third instrument played was a small, commercially made xylophone. This resembled the pipes in playing position, but consisted of permanently mounted pieces of metal about 4 inches in length and 1-1/2 inch in width. These
were mounted on a frame chromatically and had a range from the second octave C to third octave F. The sound was produced by striking the bars with the same mallet that was used on the pipes.

The fourth instrument used was a wooden soprano recorder. This instrument, like the flute, is a wind instrument; that is, its sound is produced by blowing air into it. This is a popular instrument because of its pure tone quality and easy fingering system. Its range covers two octaves, beginning on the C one octave above Middle C. In quality and timbre, the tone produced by the recorder resembles the human voice more than any other instrument.

The fifth and last instrument played was the alto melodica. This is a commercially manufactured reed instrument. The sound is produced by blowing into it and depressing a series of white and black keys that resemble the piano keyboard arrangement. The sound that is produced is very much like that of an accordion. Its range stretches two octaves from the F below Middle C to the F two octaves above. For a comparative analysis of the range of the five instruments see Figure 1.

Each instrument was played separately by the author, and the child's response was recorded on paper (see Appendix) according to how many high and low pitches he accurately identified verbally and by movement on the stairs. His directional knowledge of high and low was also recorded.

Pilot study

Two pilot studies were conducted by the author for the purpose of acquainting her with the instruments and testing procedures. The first,
Figure 1. Comparative range of instruments.
conducted at the Child Development Center, proved to be unsuccessful, so the author felt it was necessary to conduct another study at the Child Development Lab. The Center is located on the northern edge of the campus of Utah State University, near the married student housing area, and was organized primarily to serve students at Utah State. As a result, the children, ranging in age from three to five, came from various backgrounds and income brackets. Children whose parents came from Persia, South America, India, Iran and other locations including North America, were tested, the only stipulation being that they understood the concepts of high and low in the English language.

The same instruments explained previously were used, the one difference being that two sets of stairs were used back to back. The difficulty found with this arrangement was that one set of stairs was about 1-1/2 inches higher than the other, so the height back to back of the sets was not level. This was confusing to the child who had acquired fine discrimination skills for the directions high, low and middle. The middle stair, as a consequence, was not easily recognized and established. Because of this inconsistency, it was decided to use only one set of stairs.

The pilot test administered at the Center proved to be frustrating, but quite helpful nonetheless. The room available for use was located upstairs, which proved to be a long, tedious climb for the children. It was very warm, distracting, and many interruptions resulted as curious adults peered in and out of the entrance. Many of the children were too immature, and many did not possess the language skills necessary to follow the directions of the test. The author then decided to conduct the second study using a sample of children
from the lab under her direction in the Child Development Department at Utah State.

These children were older in age and maturity and held a more consistent social background. They were drawn from the same circumstances as the group that was to be tested. The results proved to be satisfactory.

As a result of this pilot study, it was decided to use one set of stairs because the two, as mentioned before, confused the children, to play the musical instruments in the same order each time a child was tested to prevent further confusion, and to try and keep the two mallet instruments from view of the child in order to eliminate any visual left to right, low to high cue that the child may have assumed. It was also decided to test the older children, between the ages of four and five years old, because their cognitive skills were further developed.

Testing procedures

The actual testing experiences took place in a small room used for research at the Child Development Laboratory.

The musical instruments used were set up on two small tables but not in the order to be played, and out of reach of the children. The stairs were placed against one wall, the instruments against another, but not directly across from each other.

Each child tested was taken individually from his lab during a free play period and asked if he would like to help the author with an important project. The child was then taken to the research room and, upon his examination of the
set of stairs, was asked by the author if he had ever seen them before. If the child's answer was negative, the author explained that these stairs were used for children to climb on, and that he would be able to climb on them too. If the child answered positively to the author's previous inquiry, the child was told that he would receive a chance to climb on them again.

The author then asked the child, "If you wanted to place yourself the very highest you could, which stair would you stand on?" If the child gestured toward the highest stair, he was encouraged to tell the author that the stair was the highest, then move to the highest stair. If the child immediately climbed to the highest stair, the author would again encourage a verbal response from the child describing his movement before going on.

The same procedure was used involving the low stair, the author's question being, "If you wanted to place yourself the very lowest you could, which stair would you stand on?" Always a verbal and physical response was required from the child in regard to his motions.

The exact procedure again involved the child's movement and verbal response to the middle stair, the author's question being, "If you were to place yourself right in the very middle, which stair would you stand on?" The order of the questions concerning the directional aspect of high and low on the stairs remained the same throughout the test.

Upon the child's correct response and movement he was praised and told that he was doing well. The child's response to the directional high and low, whether incorrect or correct, was then recorded on a sheet of paper by the author (refer to Appendix).
After the child had completed his response to the author's last question concerning the middle stair, the child was left standing on the middle stair while the test was continued. The child was asked if he knew what kinds of things were on the tables in front of him. If the child responded negatively, the author explained that these were musical instruments that made sounds high, low and in the middle. If the child recognized the objects as instruments, then the author continued with the following question: "If you heard a high tone on one of these instruments, to which stair would you move?" The child was to give his response in any order, both verbally and with the correct movement on the stairs. The author used the same format and inquired of the child concerning low and middle tones heard on the instruments. The child was encouraged to respond both verbally in his own words and with movement on the stairs until he was comfortable with the concepts of high, low and middle as they related to the stairs. Typical verbal responses were "up to this one," "down low," and "up high." After this exercise was completed, the author proceeded to test the child using the individual instruments.

To begin with, the homemade pipes were played. A pipe with a tone close to the middle of the instrument's range was struck. The child was told that this was the pipe's middle tone and he was reminded by the author that he was standing on the middle stair. If he was not standing on the middle stair, he was asked to do so. This middle tone was used as a reference point, since high and low pitches must be discussed in relative terms as in the case of anything high or low. The child was then told by the author that the next tone he heard would be either higher or lower than the first, and that he was to move
up or down on the three steps accordingly. The author then struck another pipe, either higher or lower than the middle starting tone. The child moved on the steps accordingly, at this time responding verbally only if he wished. Most preferred to do so. The response that was made by the child to the varying pitches of the instruments was recorded in the same manner as his directional knowledge of high and low (refer to Appendix).

All the other four instruments were presented and tested in the same manner. There was no set order in determining which pitch was to be played first, high or low; however, the constant middle pitch as a starting point was always established for each instrument before going on to the others.

Many of the children, upon seeing the instruments, wanted to play them by themselves. The author explained that they would have a chance to do so after they finished with the "project" or "game." Upon finishing the test, the children were allowed to experiment with any instrument that they wished.

After the test was completed, and the child had experimented as he wished, he was thanked for his help and escorted back to his lab. The duration of each session with each child averaged about five or six minutes.
FINDINGS

Presentation and discussion of findings

The hypothesis predicted that children would identify high and low pitches more easily in some instruments than in others. The results of this study seemed to support this hypothesis in that one instrument, the recorder, received more correct responses than any other.

Each child was instructed to move to a higher or lower step on the stairs on which he or she was standing, in response to hearing a high or low note played on each musical instrument.

The data in Table 1 reveals that there were 42 correct and 28 incorrect responses to the recorder, 28 correct and 42 incorrect for the pipes, 29 correct and 41 incorrect for the flute, 17 correct and 53 incorrect for the xylophone, and 23 correct and 47 incorrect for the melodica. There were more positive responses for the recorder, and more negative responses for the xylophone than any other instrument.

The difference in total response to the recorder as compared with the other four instruments was significant at the .0001 level of confidence. It seems, therefore, that the difference was not due to chance. There may be other influencing factors, which will be discussed later.

The recorder is compared to the other instruments, individually, in Table 2. Again, the superiority of the recorder was found to be statistically significant and not due to chance.
Table 1. Chi-square analysis of children's responses to sounds from musical instruments.

<table>
<thead>
<tr>
<th>Musical instrument</th>
<th>Number of correct responses</th>
<th>Number of incorrect responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipes</td>
<td>28</td>
<td>42</td>
</tr>
<tr>
<td>Flute</td>
<td>29</td>
<td>41</td>
</tr>
<tr>
<td>Xylophone</td>
<td>17</td>
<td>53</td>
</tr>
<tr>
<td>Recorder</td>
<td>42</td>
<td>28</td>
</tr>
<tr>
<td>Melodica</td>
<td>23</td>
<td>47</td>
</tr>
<tr>
<td>Total</td>
<td>139</td>
<td>211</td>
</tr>
</tbody>
</table>

Degrees of freedom = 4

Chi square = 20.45 (P < .0001)

Table 2. Chi-square analysis of children's responses to sounds of pipes, flute, xylophone, and melodica as compared with responses to the recorder.

<table>
<thead>
<tr>
<th>Musical instrument</th>
<th>Number of correct responses</th>
<th>Number of incorrect responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipes</td>
<td>28</td>
<td>42</td>
</tr>
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</tr>
<tr>
<td>Recorder</td>
<td>42</td>
<td>28</td>
</tr>
<tr>
<td>Melodica</td>
<td>23</td>
<td>47</td>
</tr>
<tr>
<td>Recorder</td>
<td>42</td>
<td>28</td>
</tr>
</tbody>
</table>

Chi square = 20.45 (P < .0001)
Since the recorder was found to be superior to the other four instruments in the number of correct responses, both high and low (see Figure 2), its success may be attributed to the fact that the quality of its sound very much matches that of the child's own voice. Also, the system of overtones emitted in a single tone of the recorder is relatively simple in structure. These types of sounds may be more easily heard and accurately distinguished by children.

The xylophone appeared to be the instrument that was most confusing to the children. It received the fewest correct responses. In Table 3 one can see that the difference was significant between the xylophone and each other instrument except the melodica.

Table 3. Chi-square analysis of significance of difference in children's response to xylophone as compared to responses to the pipes, flute, and melodica.

<table>
<thead>
<tr>
<th>Musical instrument</th>
<th>Number of correct responses</th>
<th>Number of incorrect responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xylophone</td>
<td>17</td>
<td>53</td>
</tr>
<tr>
<td>Pipes</td>
<td>28</td>
<td>42</td>
</tr>
<tr>
<td>Flute</td>
<td>17</td>
<td>53</td>
</tr>
<tr>
<td>Xylophone</td>
<td>29</td>
<td>41</td>
</tr>
<tr>
<td>Melodica</td>
<td>17</td>
<td>53</td>
</tr>
<tr>
<td></td>
<td>23</td>
<td>47</td>
</tr>
</tbody>
</table>

df = 1, P < .05. The difference is not significant and could be due to chance.
Figure 2. Total correct responses to high and low sounds of each musical instrument.
The author is not certain as to why the xylophone was least effective. In comparison, the xylophone was similar to the other instruments in range (see Figure 1, page 17) and was similar to the pipes in material and playing manner (mallet type instrument). Its ineffectiveness seems not to be a result of the above, and further studies would have to be conducted to determine why the children did not respond to this instrument more favorably.

The melodica was compared individually with the pipes and flute, only to reveal that there was no measureable significance in the different response patterns (see Table 4).

Table 4. Chi-square analysis of significance of children's response to melodica as compared to responses of children to the pipes and flute.

<table>
<thead>
<tr>
<th>Musical instrument</th>
<th>Number of correct responses</th>
<th>Number of incorrect responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melodica</td>
<td>23</td>
<td>47 df = 1</td>
</tr>
<tr>
<td>Pipes</td>
<td>28</td>
<td>42 not significant</td>
</tr>
<tr>
<td>Melodica</td>
<td>23</td>
<td>47 df = 1</td>
</tr>
<tr>
<td>Flute</td>
<td>29</td>
<td>41 not significant</td>
</tr>
</tbody>
</table>

The number of high and low responses to the flute, pipes and melodica were closely related in number, the pipes and flute differing by only one. The latter comparison was not expected by the author, since the two instruments are very different in nature and sound production. The flute, being a very precisely made instrument, has pitches, when played, that are very accurate
and clear. The pipes, however, are made of an inexpensive metal and are simply cut into differing lengths, producing a tone of a lesser quality. Perhaps because the pipes were the first instrument presented to the child, his interest in the instrument was more intense, and his attention focused to a higher degree.

Visually, there appears to be a substantial difference in children's responses to high and low tones on the melodica (see Figure 3). This was probably attributed to chance, although this instrument was the only one in which the child heard octaves as the high, middle, and low pitches. Since this was a variance from other procedures, a further study would have to be made to determine if a child hearing three different octaves of the same note name had any bearing on his ability to differentiate between high and low pitches.

There seemed to be little difference between boys and girls in their responses to each instrument (see Figure 4). The differences that did exist were very minor, usually only one or two children. For that reason, the author felt no need to depict any difference statistically.

Discussion

From the pilot study, it was concluded that maturation played an important part in the child's ability to recognize high and low pitch differences. The older child possessed the labeling skills necessary to name directional high and low and also the ability to associate the directional aspect with the musical concept of high and low pitch.
Figure 3. Correct responses to high and low sounds from each musical instrument.
Figure 4. Correct responses by boys and girls to high and low sounds from each musical instrument.
Most children that the author tested were very willing and cooperative with her. The children of the afternoon lab were especially accommodating. This could have been because the children had been briefly acquainted with the author during their associations with the two labs (the author's and their own) during outside free play.

Of the 35 children tested, only three of these could not identify the directional aspects of high and low, verbally or in movement. One girl attempted some response but could not keep her attention on the author's questions. She would climb up and down on the stairs and show the author how she could jump from each level. When the instruments were brought to her attention, she could not consistently identify the pitches, and her attention span was so short that she could not keep her mind on the instrument that was being played but wanted to try all the others at the same time. The other two boys had very little concept of low and high. When questioned by the author, they were silent, motionless, and made no gesture as to whether they recognized the direction at all. One boy was interested in the instruments and wanted to play them, the other showed no interest at all.

One interesting response from a few children led the author to believe that some children may not possess the necessary verbal labels to identify pitches as high and low. As an example, one child, upon hearing the low, resonant sounds of the melodica, exclaimed, "That was a big one!" She immediately moved to the higher stair and consistently did so when she heard any low pitch.
One child went so far as to trade positions with the author. "Now you play the game," he said. "When I play a high note you move high." The child was using the melodica and played all of its pitches. This continued for three minutes or so, then the child was escorted back to his lab, obviously pleased with himself. This incident seemed to indicate to the author that the child was interested and involved with the testing procedure, which according to studies done by McGinnis (1928) and Vance and Grandprey (1931) was an important factor when testing musical abilities of the preschool child.
SUMMARY

The purpose of this study was to determine which instrument, of the five used in testing, would be the most effective when used in developing pitch discrimination in young children. The hypothesis stated that children recognize high and low pitches in some instruments more easily than in others. Consequently, some instruments may be more effective for teaching pitch concepts.

A sample of 35 children, 18 boys and 17 girls, was taken from the Child Development Labs at Utah State University. The five instruments used in the tests were a homemade set of pipes, a flute, a small xylophone, a wooden recorder, and an alto melodica. Before the child was tested for his ability to discriminate high and low pitches on the instruments, his knowledge of directional high and low was determined. After his directional knowledge was assessed, his pitch discrimination abilities were determined, using the five instruments.

The findings revealed that there was indeed a difference in children's responses to the instruments. The wooden recorder received more correct responses than any other instrument. Next came the flute and homemade pipes, then the melodica, and finally the xylophone.

In evaluating the two sexes separately, there was no great difference between the number of correct responses of the boys and the correct responses of the girls.
CONCLUSION

The findings of this study seem to support the conclusion that some musical instruments may be more effective than others as aids to development of musical pitch discrimination.

There seemed to be little difference in the responses of boys and girls; therefore, it may be concluded that sex seems to have little bearing on a child's pitch discrimination abilities.
RECOMMENDATIONS FOR FURTHER STUDIES

A similar study done with preschoolers testing pitch discrimination of various instruments using only perfect octaves as the high, middle, and low pitches.

A similar study, conducted with the same age children or older ones, to determine how well pitch could be discriminated using smaller and smaller intervals between the high, middle, and low pitches.

A similar study involving the use of different instruments, melody and harmony.

A study, constructed in a different manner, to determine tonal memory of the preschool-age child.

A similar study, conducted using a sample of older children who were classified as singers and non-singers.

A similar study involving the use of the piano along with other instruments.
LITERATURE CITED


APPENDIX
<table>
<thead>
<tr>
<th>Data Sheet</th>
<th>Pipes</th>
<th>Flute</th>
<th>Xylophone</th>
<th>Recorder</th>
<th>Melodica</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
</tr>
</tbody>
</table>
VITA

Farol Ann Groutage Nelson

Candidate for the Degree of

Master of Science

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Major Field: Family and Human Development

Biographical Information:


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