EFFECTS OF MENTAL AND PHYSICAL PRACTICE ON 6TH GRADE BEGINNING BAND INSTRUMENTALISTS' PERFORMANCE ACCURACY

by

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ABSTRACT

The purpose of this study was to examine the effects of three practice conditions on beginning band instrumentalists' performance of a short musical selection. Fifty- nine sixth grade beginning band students were randomly assigned to either a physical practice, mental practice, or no practice (control) treatment. A pre-test score was obtained by having each subject sightread selection #2 from Form A of the Watkins/Farnum Performance Scale. Subjects were then given instructions according to the practice condition to which they had been assigned. After a three minute practice session, subjects were asked to perform selection #2 from Form B of theWatkins/Farnum Performance Scale to obtain a post-test score. All of the performances were tape recorded and scored on the basis of correct pitches and rhythm patterns by three music teachers. Mean scores were analyzed using a one-way ANCOVA and a Scheffe´ Test. The results of the study indicated that students in the physical practice condition scored significantly higher than those in the control group. Mental practice was not significantly different from either the physical practice or no practice (control) groups.

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Chapter I

INTRODUCTION

High school students stood in awe as they watched their math teacher sink 98 out of 100 free throws in the school's gymnasium. When asked how he did it, the teacher explained that shooting free throws is a matter of mental concentration. Many athletes and musicians often respond with the same answer when asked about the key to their success. Mental practice has been used for centuries by hunters and in sports and music. Despite the pervasive use of mental practice through time, the true nature of mental practice and its specific benefits have, until the 1900's, remained unknown. The majority of research on mental practice since the 1930's has determined that mental practice can have a positive effect on the performance of athletic skills such as basketball, bowling, dart throwing, golf, ring tossing, swimming, volleyball, soccer and gymnastics and on the musical performance of college musicians.

There are many parallels between the problems that athletes and musicians face. Ross (1985) details an example of the golfer who, "failing in a first attempt to blast out of a sandtrap, rushes into a second and third attempt before stopping to analyze what went wrong with the initial shot" (p. 222). Just like the golfer, young musicians who use physical practice often fail to analyze their first mistakes, resulting in poor habits that may take hours of practice to undo. Research indicates that mental practice is effective in improving the performance of many different tasks. (Beasley, 1979; Clark,

1960; Coffman, 1991; Ross 1985; Schick, 1971) For this reason, mental practice could be one way to improve the performance of young musicians while avoiding the pitfalls experienced by the golfer in the example above.

Mental practice began to receive much attention by researchers after research by Jacobson (1930 d) indicated that there were real physiological forces taking place during mental activity. His research was based on information obtained through the use an an electromyograph which he developed to measure electrical activity in muscle tissue. Based primarily on Jacobsen's research, a psychoneuromuscular theory was formed (Arnold, 1946), which suggested that the process of imagining a movement results in an actual, though minimal, innervation of the muscles used in that activity. Though no visible movement takes place, this innervation is presumed to transfer into the physical performance of a skill. In other words, mental practice should transfer into increased physical performance. While the majority of research on mental practice lends credibility to Arnold's theory, two studies (Start, 1964; Ryan, Blakeslee, and Furst, 1986) determined that mental practice was not effective in improving performance.

Several studies have concluded that although performance can improve through the use of mental practice, the value of mental practice is specific to the type, complexity and skill level of the task being performed (Clark, 1960; Oxendine,1969; Phipps and Morehouse, 1969; Schick, 1970; Ulich, 1967). Clark found that the experienced athletes in his study benefited equally from mental and physical groups while the novice athletes benefited more from physical practice. In contrast, Schick found that subjects

with little volleyball skill benefited more from mental practice than those with advanced skills.

Mental practice has been just as effective as physical practice in improving performance of subjects on a variety of tasks including the ring-toss, the Pacific Coast one hand foul shot, the action-reaction start used in competitive swimming, the dart-throw, and a chemical lab experiment (Twining, 1949; Clark, 1960; White and Lewis, 1978; Mendoza and Wichman,1978; Beasley, 1979).

Generally speaking, a practice schedule combining both mental and physical practice appears to be of the most value in improving performance of a task or skill. Studies supporting this include the O'Conner Finger Dexterity Test, typewriting and a rivet task (Ulich, 1967), the action reaction start in swimming (White and Lewis, 1978), and performance of college trombonists (Ross, 1985).

Other factors, as well, appear to effect the performance of subjects using mental practice. Powell (1973) and Wichman and Lizotte (1983) found that mental practice is more effective for subjects having an internal locus of control than for those with an external locus of control.

Research by Ross (1985) spawned a series of experiments by researchers on the effectiveness of mental practice in music performance. College trombonists in Ross's study did not benefit from mental practice. On the other hand, Coffman (1991), investigated the effects of different practice conditions on piano performance and found that mental practice resulted in performance that was significantly better than that of the control group.

Rosenthal, Wilson, Evans, and Greenwalt (1988) found mental practice to be more effective than either physical practice or a combination of mental and physical practice in improving the performance of rhythms in a musical exercise.

Perhaps the most important point brought out by the research on mental practice is that it's effectiveness varies from one task to another. This phenomenon is related, in part, to the complexity and type of task as well as the skill level of the person performing the task. Because of the varied conclusions of the research on mental practice and because the effectiveness of mental practice on young musicians has not been explored, further research needs to done before determining the exact relationship between mental practice and musical performance on the beginning band level. This study will attempt to determine the effectiveness of mental practice by using three treatment conditions:

(a) mental practice: subjects will silently study the music without benefit of kinesthetic movement.

(b) physical practice: subjects practiced by actually playing the horn.

(c) control group: subjects counted backwards from 200 until the 3 minute practice time elapsed. The counting task was used to prevent mental rehearsal of the music.

Purpose

The purpose of this research was to determine the effectiveness of mental practice in improving the performance of pitch and rhythm patterns

of sixth grade beginning band instrumentalists.

Objective

The objective of this study is to answer the following question:

Is mental practice a viable means of improving the performance of pitch and rhythm patterns for sixth grade beginning band brass and woodwind players?

Hypothesis

There will be no differences between the performance of subjects using mental and physical practice and those in a control group.

Limitations

Mental practice is an introspective activity and provides no overt movements to observe making it difficult to control what goes through the subject's mind during mental practice. There is no way of guaranteeing that all of the subjects will understand the instructions the same way. Also, since mental practice cannot be directly observed there is no way of knowing exactly what the subject was thinking during the mental practice time or how much time was actually devoted to practicing.

Chapter 2

REVIEW OF LITERATURE

The purpose of the literature review is to determine the circumstances under which mental practice becomes a viable method of acquiring or improving a skill. This review will synthesize literature in three areas of research on mental practice. First, the physiological aspects of mental practice will be examined. The second area will be an overview of research using mental practice with a variety of tasks and subjects. Finally, the third area will examine research using mental practice in musical performance.

Physiological Aspects of Mental Practice

Research on mental practice goes at least as far back as 1892 when Jastrow investigated the question of whether there was muscular activity during mental operations. During the 1920's, experiments by Köhler (1925) revealed that apes could find the answers to certain problems without the benefits of physical rehearsal. In the 1930's Jacobsen (1930 d) conducted research in order to determine if imagining bending one arm would produce electrical changes in the bicep muscles. In order to carry out this experiment, Jacobsen first had to design an electrical device that would be able to measure electrical impulses to and from muscle tissue. Using adult volunteers, he attached electrodes to the biceps of his subjects. He discovered that when subjects had their eyes closed, then imagined bending the arm very slowly, the electrodes measured increased electrical activity in the biceps. This was the first real evidence that mental processes could induce physical

activity without actually moving that part of the body. In addition, Jacobsen discovered that if the muscles remained relaxed, the subjects could not imagine the required muscle movement for a given task.

General applications of mental practice

Ryan, Blakeslee, and Furst (1986) performed an experiment to determine whether the minute muscular innervations present during mental practice could improve learning of a motor skill without additional feedback in the form of knowledge of results. For this study, 28 female and 72 male volunteers were randomly assigned to one of five practice conditions: 1) Physical Practice (PP), 2) Mental Practice (MP), 3) Control (no practice), 4) Mental Imagery with Simulated Throw (MP-ST) and 5) Mental Imagery-Actual Throw Blindfolded (MI-ATB). The task to be performed required subjects to bounce a tennis ball once on the floor and have it bounce in the center of a target ten feet away. Results of this experiment showed little support for the authors' theory that "imagined or actual performance without outcome feedback, is sufficient to improve the performance of a unique throwing task" (Ryan, Blakeslee and Furst, 1986, p. 65). Those subjects in the physical practice group scored significantly better than those in the other practice conditions. None of the other groups scored significantly better than the control group. The authors of the study argue that since performance did not improve under the conditions employing muscular movement during mental rehearsal it is unlikely that kinesthetic feedback is an explanation for learning that occurs with mental rehearsal.

Results of a study by Wrisberg & Ragsdale (1979) suggest that what is actually learned in mental rehearsal is cognitive, i.e. "where the hand goes, how the finger points, how the elbow bends, etc." (p. 67). However, they also acknowledge that if the limited number of trials (30 tosses) used in this study were to be expanded to provide more extensive experience prior to performing the task, mental rehearsal might be more effective. The final conclusion of the authors is that "without corrective feedback provided by actual practice, the learner is unable to pick out and correct errors, kinesthetic or neuromuscular innervation brought about by mental rehearsal did not improve an unskilled performance" (p. 68).

Until the 1960's most studies involving mental practice had focused on it's effect on the learning of motor skills. Start (1964) focused his research on subjects' ability to imagine muscular movement as measured by the Wiebe Test of Kinesthesis and resulting benefits from mental practice. Start described kinesthesis as the "perception of aspects of movement, tension, resistance, position, balance, relaxation, effort, and orientation in space" (p. 317). Subjects for Start's research were 21 male college students aged 18-21. The students were given practice sheets based on a detailed analysis of a skill by an Olympic gymnast who was also a teacher. Every movement needed to carry out the skill was described on the sheet by the gymnast. As the instructor read the instructions aloud the students would close their eyes and imagine themselves performing the movements he was describing. This procedure took place 5 minutes a day for 6 days. Because of the difficulty of insuring that subjects would not try to rehearse the movements at other

times, Start spent much effort in motivating the students to observe the experimental nature of the study. After the sixth day of practice the group was asked to perform the movement they had been mentally practicing. Results of the study indicated no significant correlation between the physical performance of a gross motor skill and kinesthesis which had been mentally practiced previously. According to Start, this supports the findings of other studies comparing kinesthesis and motor learning. However, he admits that it is just as likely that the Wiebe Test of Kinesthesis and others like it could be inadequate estimates of the trait(s) being evaluated.

Research by Clark (1960) found mental practice to be nearly as effective as physical practice in learning the Pacific Coast one-hand foul shot. One hundred and forty-four high school boy were assigned to either a mental or a physical practice treatment. Stratified random sampling was based on such characteristics as grade level, experience, arm strength, etc. After a review of the proper procedures for the foul shot, subjects shot 25 consecutive free-throws to obtain a pretest score. Subjects in the physical practice group were instructed to shoot 5 warm-ups and then 25 shots for a test score for each of the 14 days of the experiment. The mental practice group was given a written description of the mental practice technique and was then instructed to imagine shooting 5 warm-ups and 25 shots. To encourage these subjects to do their best, Clark told the students to think of themselves as competing against the physical practice group.

Results of the study showed that both the mental and physical groups achieved significant gains in performance. When data for the stratified

groups was analyzed, Clark found that physical practice resulted in average gains of 16% for the varsity groups, 24% for the junior varsity groups, and 44% for the novice groups; mental practice resulted in average gains of 15%, 23% and 26% for the equivalent categories. Thus, the more experienced players benefited almost equally from either practice treatment while the novice group appeared to benefit more from physical practice. Clark concludes that "perhaps a certain amount of motor experience is necessary before mental practice will provide a maximal effect" (Clark, 1960, p. 568).

Ulich (1967) carried out a series of studies to determine the effectiveness of mental rehearsal on the O'Connor Finger-Dexterity Test, a typewriting excercise and riveting loops in pasteboard cards. Subjects for each experiment were divided into five groups as follows: MP-Alternated trials with mental and physical practice, PP-Physical practice, MP-Mental Practice, OBS-observation and NP-no practice (control). Subjects for the task utilizing the O'Connor Finger-Dexterity Test were 50 male and female students, 12 to 13 years old. Each group had four trials of 5 minutes each with a 10 minute rest between each practice trial. A training period of 5 minutes was used to assess the results of the various treatment conditions. Results of the test showed that the subjects in the combination mental/physical and physical practice conditions scored the highest. Also, subjects in the mental practice group scored significantly higher than those in the no practice group.

Subjects for the typewriting experiment were 75 students, 16 years of age, at a commercial school. Final results of this task were similar to those on the O'conner Dexterity task. The highest scores on this task occurred with

the combination mental/physical practice group followed by the physical practice group while subjects in the mental practice group scored significantly higher than those in the no practice group.

The loop-rivet task used fifty 16 year old male technical apprentices as subjects. Subjects used a press to rivet 14 loops in 2 paste-board cards in a given sequence. Subjects had four 10 minute trials each with a 15 minute rest between each trial. Unlike the O'Conner and typewriting tasks, the highest gains in performance of the rivet-loop task occurred in the physical practice group followed by the combination practice group. Performance of the mental practice group was not significantly better than that of the no practice group. Ulich thought that perhaps these confounding differences could be attributed to the attitude and working experience of the apprentices differing from those of students in the other experiments.

Phipps & Morehouse (1969) investigated the effectiveness of mental practice on three tasks of varying degrees of complexity and found that mental practice seemed to help simple tasks more than complex ones. In this study, 80 male volunteers from a required university physical education program and with no previous instruction in gymnastics, or competitive experience with football and soccer, were assigned to either a control group or a mental practice group for the learning of 3 motor skills, the hock swing, jump-foot and soccer hitch kick. Subjects met 3 days a week for 3 weeks and a new skill introduced each week. Students in the control group participated in their regularly scheduled physical education classes but were called from class individually and given a demonstration of the skill to be performed for that

week. Subjects were informed that they would be given 10 attempts to successfully perform the skill. The trial on which the subject passed the test was recorded by the observers. The mental practice subjects met in small groups and had 5 mental practice sessions a week. During the first meeting of each week, mental practice groups were given a demonstration and written handout describing the skill to be learned and any questions by the subjects were answered. Subjects were then asked to "relax, close their eyes, and imagine themselves performing the skill as they were directed through repetitions of it" (Phipps and Morehouse, 1969, p. 774). This procedure was repeated 10 times during each practice session.

The first analysis of data compared the number of subjects from each group who were successful during the initial trial on each of the three skills. The rationale for this comparison was that physical practice would occur with each subsequent attempt of the task resulting in a contaminated mental practice condition. Using chi-square values, mental practice was shown to have significant advantage over the control group only on the hock swing. Phipps and Morehouse then compared the mean number of trials required to achieve success for each group on the posttest. When the effects of physical practice during the testing were included, subjects in the mental group required significantly fewer attempts to achieve success in the hock-swing and the jump-foot than did those in the control group. Performance of the two groups in the hitch-kick was not significantly different. In summary these two comparisons illustrate that without physical practice, mental practice was effective only for subjects learning the hock swing. The addition of physical

practice improved subjects performance on the jump-foot task but no combination of practice was effective for the most difficult task which was the soccer hitch kick. Furthermore, analysis of the data indicated that there was not a significant difference in the difficulty level of the hock-swing and jump-foot since 49 subjects passed the hock swing test and 46 passed the jump-foot test. Although a pilot study for this experiment showed that the three skills were of varying difficulty, these results indicate it is possible that there was actually little difference in the complexity of these two skills. Phipps and Morehouse conclude that "perhaps the value of mental practice depends not only on the difficulty of the skill but is also specific to even the simpler skills" (Phipps and Morehouse, 1969, p. 778).

Additional research by White and Lewis (1978) on the learning of complex skills investigated the effects of mental practice and physical practice on learning the action-reaction start used to begin competitive swimming events. Twenty-four high school and university students ranging in age from 13 to 27 volunteered to serve as subjects for this experiment which took place over an 8 day period. Subjects were assigned to 1 of 4 practice conditions: (a) Physical Practice (PP), (b) Mental Practice (MP),
(c) Combination of Mental Practice and Physical Practice (MP/PP) or (d) the control group. Subjects in the PP Group participated in four 10 minute sessions of individual instruction. Those in the MP treatment were given a detailed list of 15 steps along with 6 diagrams illustrating the correct technique for this skill. After all questions were answered, the MP subjects were told to mentally rehearse the material one step at a time for 5 minutes

per night during the 8 day period. Subjects in the MP/PP group followed the practice schedules for both the MP and PP groups for a total of 80 minutes of practice time. The control group was given instructions to return in 8 days for the next session. Analysis of the results indicated that performance for the MP/PP group was significantly better than in any other group. The PP and MP groups also exhibited a significant increase in performance when compared to the control group and both were similar in their effectiveness in learning the action/reaction swim start.

In another experiment, Oxendine (1969) investigated the effect of different schedules of mental and physical practice on three different tasks: The pursuit rotor which involved keeping the end of a hinged stylus in contact with a revolving target, a soccer kick in which subjects were to kick a ball towards a wall and make it bounce into a target area, and a modified jump shot which required subjects to stand 10 feet away from a 9 foot goal and shoot with an 8 1/2 inch ball. For each skill, subjects were divided into four groups, each employing a different percentage of mental and physical practice. Group 1 used 75% physical/25% mental practice, Group 2 used a 50% physical/50% mental, Group 3 used 25% physical/75% mental practice and Group 4 used physical practice only during a period of 7 days.

Evaluation of subjects' performance was completed by employing a pretest, a posttest and a repetition of the posttest three weeks later to measure retention of the skills by each group. Scores for the pretest on the pursuit-rotor task were exactly the same for all groups. Use of a t-test on posttest scores found significant improvement in all four groups on this task. Further

analysis showed that the two groups using more than half of the time as physical practice scored significantly higher than the groups that utilized mental practice for 50% or more of the practice time. Analysis of the retention test data found no significant differences between groups on retention of performance skills. Results of the modified jump-shot task were quite different. The only group to achieve a significant gain in performance skills was the all physical practice group. However, when comparing retention of the task among groups after a three week period, there appeared to be no advantages of one practice schedule over another. Oxendine concludes "that the modified jump shot was inappropriate as a learning task for seventh grade boys under the conditions used in this study" (1969, p. 760).

Following this experiment subjects were asked for their personal reactions to the use of mental practice in learning a skill. The validity of this study immediately came into question when some students openly admitted rehearsing the tasks mentally at other times other than during the regular experiment schedule. Oxendine did not make any effort to control the amount of mental rehearsal outside of the experimental practice schedule and as a result limited the validity of the results of his experiment. Overall, most of the students did believe that use of mental practice had been beneficial while the majority of negative comments toward mental practice came from the group that spent 75% of it's practice time in mental practice.

The negative comments of these subjects might be explained in earlier research by Twining (1949) when he found that most of the subjects in his study could only give a genuine mental practice effort for about 5 minutes.

After that time, concentration became more and more difficult. Twining's experiment used 36 men randomly selected from the University of California at Berkeley and had them practice a ring-toss task under one of three practice conditions: a control group (no practice), mental practice group and physical practice group. The experiment required that subjects toss 6 inch diameter rings at a one foot high wooden peg which was 10 feet away. All subjects were given the same instructions by the experimenter on stance, arm action, etc. The mental and physical practice groups met for 21 days while the control group met only on the initial and final practice sessions. Scores for subjects in the control group improved insignificantly at only 4.3%. However, scores for both the mental and physical practice groups increased significantly at 36% and 137% respectively. Thus, Twining was able to conclude that at least under the conditions of this experiment, both mental and physical practice can aid the learning of a simple motor skill.

A study investigating the effects of mental practice on dart throwing was conducted by Mendoza and Wichman (1978). In this study, 32 college undergraduates from Claremont Men's College were randomly assigned to one of four experimental groups: (a) Control Group (NP), (b) mental practice only (MP), (c) mental practice with simulated dart throwing muscular movements (MP-ST), (d) and direct physical practice (PP). A dart board was positioned three meters away from the throwing line and 1.6 meters high. A pretest performance measurement was obtained by having each subject throw 25 darts and recording the score. Subjects in the control group were told to return in 7 days while those in the experimental groups were told to report

for two 15 minute practice sessions per day for the next 6 days. A posttest was administered with the performance score based on 25 consecutive throws as in the pretest.

Gain scores for each subject were determined by subtracting the pretest scores from the posttest scores. The MP (21.6) and MP-ST (23.5) groups in this experiment proved to be very effective in improving dart throwing performance when compared to the control group (5.6). The PP group showed the most improvement of any group with a gain score of 34.3. Also, *ex post facto* analyses between the groups indicated that there was no significant difference between the relative effectiveness of the two types of mental practice employed in this experiment. However, there was a significant difference between the all physical practice group and all other groups revealing that all physical practice group was the most effective form of practice in this experiment.

Wichman and Lizotte (1983) investigated the effects of mental practice and locus of control on dart throwing. Each of the 35 high school students who participated in this experiment were administered the Nowicki Strickland locus of control scale. Based on the results of the test, 18 students were classified as highly internal and 17 as highly external. A pretest performance score was obtained for each subject using 18 throws. Subjects were then randomly assigned to either an all mental practice condition or a control group (no practice). Participants assigned to the control group were told to return in 5 days while those in the mental practice group were told to return once a day for the next four days for a 7-minute practice session. The

mental practice technique required subjects to sit comfortably with their eyes closed and hands in their lap as they imagined all of the body movements required to throw each dart. Subjects practiced for 3 minutes, rested for one minute and then practiced for 3 more minutes. They were also told to correct for imagined misses. Following the last day of practice, students threw 18 consecutive throws to obtain a posttest score. The pretest score was then subtracted from the posttest score to determine gain scores.

Scores for subjects in the mental practice condition improved significantly more than for those in the no practice condition. In addition, mental practice was found to be more effective for subjects having an internal locus of control than for subjects with an external locus of control.

The dart throw was also the target of Powell's (1973) investigation into the effects of negative and positive mental practice on learning a new skill. In this type of practice subjects imagine that the results of each throw are either accurate or inaccurate. Subjects in this study were 18 female clinical psychology students matched to either a negative (G-) or positive (G+) practice condition based on a pretest dart throwing score. The rehearsal schedule consisted of 5 blocks of throwing 24 darts. Blocks 1, 3, and 5, consisted of actual physical practice while blocks 2 and 4 consisted of mental practice. Subjects in the G(-) group imagined very poor throwing while those in the G(+) group imagined that their darts landed in or near the center of the target. According to Powell, subjects in the G(+) group improved significantly when compared to the G(-) group. Throwing accuracy For the G(+) group improved by 28% from the first to the last block while performance of the G(-) group

actually declined by -3%. Powell was surprised by this decline in performance since one would expect at least some improvement as a result of the actual experience of throwing darts in blocks 1, 3, and 5. Powell hypothesized that perhaps the decrease in performance by this group could be a result of false feedback caused when subjects aimed for the center of the dartboard but imagined that their darts landed in places other than the center.

Schick (1970) conducted a series of three studies to investigate the effects of mental practice on the wall volley and serve used in volleyball. The first study investigated the effects of mental practice versus no practice. Subjects for this study were 10 college women who were not enrolled in a volleyball class or on a team but who had some experience in volleyball. The participants in the mental practice group rehearsed at home for two weeks, spending three minutes on the serve and three minutes on the wall volley. Results of the posttest indicated that there was no significant difference between the two groups on the wall volley. However, subjects in the mental practice group scored significantly higher than subjects in the no practice group on the serve.

The second study used 68 women college students enrolled in a volleyball class to determine the effectiveness of a a combined schedule of mental and physical practice on the serve and wall volley. After taking a pretest, subjects were classified into low, medium and high skill groups and and then randomly assigned to one of two experimental groups. Both groups used equal amounts of physical practice, but one group used only 1 minute of mental practice while the other used 3 minutes of mental practice.

Analysis of the data again revealed no significant difference in performance between either group on the wall volley, regardless of the amount of time spent on mental practice. The group which used 3 minutes of mental practice per day scored significantly higher than the group using only one minute on the serve. Further analysis revealed that most of this improvement could be attributed to subjects in the low skill group. The third study was basically a repetition of study II with the exception that the duration of the experiment was three weeks instead of five. Subjects for this experiment were 36 college women enrolled in two volleyball classes. Although Schick did not state whether the groups showed improvement or not there were were no statistically significant differences between the two groups in this experiment. In conclusion, none of the three studies found that mental practice can significantly improve performance of the wall volley skill while, on the other hand, mental practice was effective overall in improving performance of the volleyball serve.

Singer and Witker (1970) found that mental practice may be more beneficial if introduced earlier in a practice schedule rather than later. Sixty-five college women were assigned to one of five practice groups each using a different schedule of mental and physical practice, to learn a pursuit-rotor task. The groups differed in that mental practice occurred either on practice trials 1 and 2, 3 and 4, 5 and 6, or 7 and 8. Group five served as a control group and used all physical practice. Results showed that physical practice and combined physical and mental practice were equally effective in learning a psychomotor task. In addition,the researcher found no conclusive

relationship between the point of introduction of mental practice in a rehearsal and performance gains on the pursuit-rotor task. However, due to trends in the data, the researchers summize that introducing the mental practice earlier rather than later during rehearsals "might be a slightly more effective technique".

The interest in mental rehearsal is not limited to sports. Beasley (1979) conducted a study to determine the effect of physical and mental practice on the development of chemistry laboratory psychomotor tasks in chemistry students. Specifically, Beasley investigated the effects of mental and physical practice on student laboratory performance of a quantitative volumetric analysis experiment. Subjects were approximately 400 students enrolled in two chemistry lecture sessions at the University of Maryland. This experimental group formed 24 laboratory sections which were randomly assigned to 1 of 4 groups: (a) Physical Practice (PP), (b) Mental Practice (MP), (c) Combination of Mental and Physical Practice (PP/MP) and (d) Control (no practice).

A teaching module was developed for students in the physical practice group that provided instruction in the correct use of the balance, the pipet, and the buret. Within each skill section of the 16 page booklet was an exercise for each student to complete in the laboratory. A teaching module was also developed for students in the mental practice groups. This book was similar to the one used by students in the physical practice group with the exception that students were not asked to perform physical practice exercises inside the room. Instead, students were instructed to review the steps for completing

the lab task outside of the laboratory environment on their own time.

Each group met one time a week for 4 weeks. During the first week, all students took a pretest. In the second week, groups 1 and 3 completed the physical practice teaching module while groups 2 and 4 worked on an unrelated task. Between the 2nd and 3rd weeks, groups 2 and 3 completed the mental practice teaching module. During the 4th week all students were given a posttest on the task.

No significant differences were found between the groups using either physical practice, mental practice or a combination of both. However, when compared to the control group all three of these practice conditions yielded significantly better performance results.

Beasley's finding that mental practice was as effective as physical practice in this study was contrary to results other earlier studies. He argues that the effectiveness of mental practice in this experiment was, possibly, due in part to prior experience by the college students during the pretest experiment and/or during high school laboratory work. Most importantly, Beasley had evidence of an effective practice technique which could be utilized to complement learning without taxing limited resources in the laboratory.

Mental Practice and Musical Performance

In the 1980s researchers in the field of music education began to investigate the effects of mental practice on musical performance. Ross (1985) carried out an experiment to determine the effectiveness of mental

practice in improving the performance of college level trombonists. Participants were 30 trombone majors at three midwestern universities. Subjects were randomly assigned to one of 5 different practice conditions: (a) physical practice (PP), (b) all mental practice (MP), (c) a combination of physical and mental practice (CP), (d) mental practice with simulated slide movement (MPS), and (e) no practice (control). His null hypothesis stated that there would be no differences between the five practice treatments but he did not state an alternative hypothesis prior to carrying out the experiment. He excuses himself from making such a hypothesis because of the lack of research on mental practice in music performance as well as a general lack of knowledge among researchers as to how mental practice improves performance and to the countless extraneous variables that can confound studies dealing with mental practice or tasks.

For the musical selection, Ross chose an etude from the School of Sight Reading and Style, Book A, by Andre´ Lefoss. Subjects in the PP group physically performed the etude three times in a row after the pretest. The MP group was instructed to mentally perform the etude three times. Specific instructions were on how to see, hear and feel themselves playing the etude. The MPS subjects were instructed to hold their trombone in normal playing position and move the slide as they rehearsed the piece. Except for the slide movement, instructions for this group were the same as for the MP group. The CP subjects physically performed the etude twice with a mental practice trial in between. The control group did not practice but, instead, read an article on the importance of sight reading. After completion of the practice

trials a posttest was given. The scoring system consisted of one point for each measure of the etude played correctly (based on pitches, rhythms, and articulations). In addition, Ross controlled scoring bias by using an observer who was blind to the experimental condition under which each subject was performing.

A one-way analysis of variance was used to control for differences between group performance on the pretest. Ross found that the most significant gains in improvement occurred in the combination of mental and physical practice group and in the group using physical practice alone. Although scores for trombonists in the mental practice group were slightly higher than those in the control group, the difference was not significant. Performance improved 25% for the CP Group, 17% for the PP Group, 11% for the MPS Group, 8% for the the MP Group, and 2% for the NP Group. Ross concludes that a combination of physical and mental practice can actually produce improvement in performance equal to all-physical practice. Ross grouped correct notes, rhythm and articulations under one category- performance accuracy- so there was no indication of relationships between the independent variables and these separate musical elements.

A later study by Rosenthal, Wilson, Evans, and Greenwalt (1988) addressed the effects of different practice conditions on advanced instrumentalists' performance accuracy by placing 60 college students in one of 5 experimental groups: modeling, singing, mental practice, physical practice and no practice (control group). Specifically, the researchers wanted to determine if: (a) Modeling, singing, and mental practice are effective practice

techniques when compared with free practice or simply sight-reading and (b) if modeling, singing, and mental practice differ in their effectiveness as aids to practice. "Etude No. 96" from a book by P. Bona (1969) was used as the musical selection for the experiment because it was relatively obscure and was complex enough to challenge the graduate students participating in the experiment. Subjects in the modeling group listened to a recording of a violin performing the song. Those in the singing group were asked to sing the selection and were allowed to use a keyboard to aid in finding pitches. Subjects in the mental practice group were asked to study the music silently and without physical movement for 3 minutes while subjects in the physical practice group were instructed to practice continuously for the 3 minute period. Finally, subjects in the control group received a copy of the Watkins/Farnum Test of Musical Performance and were asked to practice it for three minutes. For a warm-up, students were asked to play through the music one time. An ID number was recorded prior to each performance.

Trained musicians listened to each recorded performance and scored the performances with respect to correct notes, rhythms, articulation, phrasing or dynamics, and tempo. The maximum score possible was 39. Results showed that performance of rhythms was best in the mental practice group. However, the other musical elements benefited little from mental practice. Subjects in the modeling condition showed the largest gains in overall performance. The authors concluded that improvement in the mental practice condition after only 3 minutes of practice attested to the benefits that mental practice can provide.

Coffman (1991) conducted an investigation into the effects of four different types of practice on piano performance. Eighty college undergraduate and graduate students (40 males and 40 females) served as subjects for the study. None of the subjects were keyboard majors and their experience on the keyboard ranged from 1 to 13 years. Four types of practice were used in the study: physical, mental, alternating physical/mental and a control group. Each of the four types of practice occurred under the presence or absence of knowledge of results for a total of 8 treatment conditions. Each subject in the experimental groups performed 6 trials with a 5 second rest between each trial. Subjects performed on a synthesizer, thus the knowledge of results was controlled by turning the amplifier on or off.

Analysis of the data indicated that all three practice conditions showed significant improvement when compared to the no practice group in improving piano performance. The physical practice and alternating mental/physical practice groups performed better than the mental practice only group. In addition, alternating mental practice with physical practice was just as effective as using physical practice alone. Although the three practice groups proved effective when compared to the no practice group, none of the practice groups achieved a significant reduction in the number of pitch or rhythm errors. Coffman explains that it is possible that the music was too difficult to obtain improvement in only 6 trials and that this might be rectified by increasing the number of trials. Also, the rigidity of the practice trials required subjects to start at the beginning of the piece each time and to stay with the metronome (m.m.40). Subjects were not given an opportunity

to work out problem spots and complained that they could not keep up with the metronome. Finally, the experiment employed massed practice which research has indicated is inferior to distributive practice (Duerkson, 1972).

Summary

Research utilizing the electromyograph to measure muscular innervations during mental activity has shown that there is a measurable increase in electrical activity of muscles in which the subject imagines movement. These findings sparked an interest in the possible benefits of mental practice by researchers in the 1940's and has led to a wealth of research on mental practice. Most studies have found that performance of a skill can improve significantly through the use of mental practice. In addition, combining mental practice with physical practice usually proves to be as or more effective as any other type of practice alone. However, the relative effectiveness of mental practice varies from one skill to another. Complexity and familiarity with the task appear to be important determining factors on the effectiveness and the appropriateness of mental practice on a given task. Also, mental practice sessions should be limited to no more than 5 minutes per session as subjects begin to lose concentration after a longer period of practice.

Research on the effects of mental practice in improving musical performance has shown that mental practice is extremely effective when combined with physical practice for advanced instrumentalists. At the same time mental practice has been found to be more effective than physical

practice in improving performance of rhythms. In light of the success that mental practice has produced in other studies, more research is needed to determine if younger, less experienced musicians might benefit more than advanced musicians from mental practice.

Chapter III

METHODOLOGY

This chapter outlines the steps taken to implement this study. Included is a discussion of the study population, sampling procedure, data collection, and data analysis. Specifically, this research utilized a pretest posttest control group design to determine the effects of one independent variable on the dependent variable, correct pitch and rhythm patterns. The independent variable is practice with three levels as follows:

mental practice: subjects will silently study the music without benefit of kinesthetic movement.

physical practice: subjects practiced by actually playing the horn.

control group: subjects counted backwards from 200 until the 3 minute practice time elapsed. The counting task was used to prevent mental rehearsal of the music.

Definitions

According to Radocy and Boyle (1988), "one may regard practice as exercising or strengthening stimulus-response connections, applying a learned response to a new stimulus, anticipatory goal-seeking responses, or searching for insight" (p. 347) In addition, practice may be defined as repetition with a goal in mind.

Mental practice may be more precisely termed "silent analysis" (Rosenthal, Wilson, Evans, Greenwalt, 1985 p. 251). During this type of practice the performer analyzes the rhythms, notes, key signature, and any other musical elements presented on the page, without the benefit of physical

movement. In addition, the instrumentalist tries to imagine the pitches (audiation or aural imagery) that appear on the page and also tries to imagine all muscular movement that will occur while actually playing the music. Audiation is an important component of mental practice.The term audiation is used by Gordon who states that "the most crucial aspect of music learning cannot be observed directly (Mark, 1986, p. 153).

Hypothesis

The null hypothesis stated that there would be no significant differences in effectiveness of the Mental Practice, Physical Practice, and No Practice treatments on performance accuracy. The null hypothesis was to be rejected at ($p<.05$).

Pilot Study

A pilot study was conducted to determine if the Watkins-Farnum Performance Scale was an appropriate musical selection for measuring performance of sixth grade beginning band students. Subjects for the pilot study were 20 seventh grade band students with 1.7 years of band experience from Lewisburg Jr. High in Lewisburg, West Virginia. Students were randomly selected from the 42 seventh graders in the band and asked to sightread selection number 3 of the Watkins/Farnum performance test. The selection was 16 measures long. The students' performances were scored on the basis of correct pitch and rhythm patterns. The maximum score possible was 16 since the test scoring instructions allow only one error per

measure. The mean score for performance of the musical selection was 13.3 with a standard deviation of 3.11 (see table 1).

Based on these results, the researcher determined that selection number two from the Watkins/Farnum test would be used for the experiment. It was previously determined by the researcher that the whole notes and half notes in selection #1 of the test would be too easy for the sixth graders in the experiment. While mean scores for the seventh graders in this pilot study were high, the selection they performed did provide a challenge to several students. As a result, there was a possibility that this selection might be too difficult for students with much less playing experience. Therefore, selection #2 was used for the experiment since it's difficulty level was between that of selections #2 and #3.

Study population

Fifty-eight sixth-grade students enrolled in beginning band at Lewisburg Intermediate and Alderson Elementary schools in Greenbrier County, West Virginia served as subjects for this experiment. The Lewisburg school is a 5-6 school with enrollment of 218. Although enrollment in band is open to all sixth grade students, all band students must go through an evaluation process in which they each try to get sounds on the different groups of instruments in the band and learn to play a simple snare drum pattern. The information obtained from these evaluations is used in recommending to students and parents which instrument may be most appropriate for each student. The band curriculum is based on the

instrumental music learning outcomes established by West Virginia Department of Education. Each student receives three 40 minute band instruction periods per week. One of these periods uses a homogeneous instrument grouping while the remaining two periods are full band rehearsals. Alderson Elementary contains grades K-6 and an enrollment of 322. Enrollment in band is open to all sixth grade students. Band meets for two 30 minute rehearsals per week and, like the Lewisburg program, the curriculum for band is based on the instrumental music guidelines established by the West Virginia Department of Education.

Sampling Procedure

It appears that, on the beginning band level, brass musicians often have more trouble than reed players in getting the correct pitches because of the embouchre requirements needed to play pitches on brass instruments. The reed player can usually get the right pitch if he/she can make the reed vibrate and push the right keys. On the other hand, brass players must not only make the lips vibrate and push the right valves or slide position but must also control the embouchre so that the note will not be too high or too low. To prevent these basic differences between the two instrument types used in this study from contaminating the experiment, stratified random sampling was used to insure an equal number of brass and woodwind players in each treatment. Stratified sampling was chosen because it "guarantees representation of the defined groups in the population" (Ary, Jacobs, and Razavieh, 1990, p. 174). A list of students in the brass section and

in the woodwind section was compiled (see Appendix A). Each band student was then assigned an identification number for use on the tape recorded portion of the experiment. Using this list, stratified random sampling was used to assign each student to one of the three experimental treatments.

Materials and Procedures

The portion of the experiment using Lewisburg students was conducted in one area of that school's gymnasium. This area was chosen because there is no music room in the school and this is the only part of the school that was not used during the afternoons when the experiment took place. The school library was used to carry out the portion of the experiment at Alderson Elementary. The experiment took place over an eight day period. Only one subject at a time was involved in the experimental treatments in order to avoid the distraction of having other students in the practice area and to prevent students from getting a preview of what they would be playing. Students were provided with a chair and music stand. Upon arrival to the practice area each subject was asked to have a seat and given 30 seconds to warm-up. The Watkins/Farnum Performance Scale was used as the measuring instrument because its two forms are equivalant. For the pretest the student was given a copy of the music and asked to perform it once straight through without stopping to correct mistakes. Each student performed selection #2 from Form A (of the Watkins/Farnum Test as the pretest (see Appendix B). Posttest instructions were presented orally to each subject according to which treatment (Physical Practice, Mental Practice or the Control Group) the subject had been assigned (see Appendix C). Form B (see

Table 1. Mean Scores and Standard Deviations for Seventh Graders' Performance on the Watkins-Farnum Performance Scale

Group	Mean scores	Standard Deviation
Woodwind	15.12	.94
Brass	12.7	4.81
Total	13.3	3.11

Appendix D) of the Watkins/Farnum test was used for the posttest. A stop watch was used to limit all practice times to three minutes and a cassette tape recorder was used to record the pretest and posttest performances of each subject. The student's ID number was recorded on tape at the beginning of each pretest and posttest performance.

Data Collection and Scoring

After all of the performances of the students had been recorded, scoring of the tape recorded pretest and posttest performances was completed by three music teachers in the Greenbrier County School System. Prior to scoring, the judges were trained as to the musical criteria they should use in evaluating the performances (see Appendix E for instruction form). Each judge was then provided with a scoring sheet, a copy of theWatkins/Farnum Performance Scale, and instructions for using the scoring sheet (Appendix F). Using the rules for scoring of the Watkins/Farnum test, the measure was the scoring unit and was counted wrong if any wrong notes or rhythms were observed. Only one error was counted in any one measure. there were 16 measures in the musical selection, so the highest score one could receive was a 16. A pitch error was defined as a tone added, omitted or played on the wrong pitch. If the student started a note with a bad attack but recovered quickly then the note was not counted as an error. Sustained notes were counted correct if the number of beats played was close to the value of the note. For example, a whole note played for 3 1/2 counts was counted correct.

Students' Rights

In order to maintain the ethical standards of the experiment, each student's right of conformed consent was observed. A letter and permission form was sent home with each student which explained the nature of the research and required the consent of each student and parent (see Appendix E).

Summary

Chapter III has detailed the steps taken to carry out this experiment. This experiment used stratified random sampling to control for differences between brass and woodwind groups. The Watkins/Farnum Performance scale was used because it is standardized and its two forms are equivalant which made it ideal for measuring musical performance in the pretest-posttest design of this study. Finally, three independent judges were used to score the performances in order to avoid experimentor bias. These procedures were used in order to obtain the most accurate data for use in the data analysis which will be discussed in the next chapter.

Chapter IV

RESULTS

Included in this chapter are the results of the data analysis. The chapter is divided into two sections. The first section includes statistics on the reliability and validity of the Watkins-Farnum Performance Scale which was used as the measuring instrument. The section also includes results of Cronbach's Alpha which was used to determine interjudge reliability. In the second section, ANCOVA was used to compare posttest means. Significant differences were found. A Scheffe´ Test was used for post hoc analysis.

Descriptive Statistics for Sample, Test and Scoring

Subjects

This study used 58 sixth grade students enrolled in beginning band at Lewisburg and Alderson Elementary schools in Greenbrier County, West Virginia. Subjects in this experiment had eight months of experience on their instruments.

Instrument of Measurement

The Watkins/Farnum Performance Scale (1957) was used as the measurement instrument in the experiment on the basis that the music would be obscure to all subjects and would not be too hard or too easy for the students to play based on results of the pilot study. In addition, the Watkins/Farnum test is standardized, and is transposed to the appropriate range and key for each band instrument. Forms A and B of the

Watkins/Farnum test are equivalent forms which makes them valid for use as pretest and posttest material for this experiment. The reliability rating between Form A and Form B is .953 for sight reading performance and .947 for practiced performance. Validity for the Watkins-Farnum test ranges between .77 and .87 for the instruments used in this study (see Table 2).

Judges

Performance scores for each subject were obtained by three music teachers from the Greenbrier County School system. Each of the judges had at least 10 years of experience in teaching beginning band students. Cronbach's Alpha was used to determine interjudge reliability. A reliability rating of .9904 was obtained for the pretest scores while reliability for the posttest scoring was .9966.

Data Analysis

Mean scores and standard deviations were determined for each treatment group. The individual scores represented the combined scores of all three judges for each subject. The maximum score a judge could give was 16 points, so a perfect score would be 48. Mean scores for the posttest ranged from 23.3 for the Control Group to 30.95 for the Physical Practice Group (see Table 3). ANCOVA was used to determine gains in performance between the pretest and posttest because it is very reliable, robust and accounts for the different skill levels of each subject. The covariate for the ANCOVA was the pretest. The F-value obtained by comparing the three practice treatments

Table 2. Correlations between Scores on The Watkins-Farnum Performance Scale and Teachers Rankings. (Watkins and Farnum, p. 5)

Type of Instrument	N	r
Clarinet and Saxophone	26	.83
Cornet and Trumpet	20	.87
Flute	12	.86
Trombone, Baritone and Tuba	18	.78
Trumpet and French Horn	18	.77

Table 3. Means table for Physical, Mental and Control Groups

	N	Mean	Std. Dev.	Std. Error
PP	20	30.95	13.07	2.92
MP	19	27.68	13.43	3.08
CP	19	23.36	14.22	3.26

was 3.79 which indicated a significant difference between groups at the $p<.02$ level (see Table 4). The null hypotheses that there would be no difference between the treatment groups was rejected at the .05 level.

A Scheffe´ Test was used for post hoc analysis. It revealed a significant difference between performance of subjects in the Physical Practice Group and those in the Control Group at $p<.001$ (see Table 5). Mental practice was not significantly different than either physical practice ($p<.24$) or the control group (.09).

Summary

Research results were presented in this chapter. Two areas of analysis were discussed. First, reliability and validity of the measurement instrument and interjudge reliability were discussed. Next, the data from the Physical Practice, Mental Practice and Control Groups were analyzed to determine if there were any significant differences between these groups. A significant difference was found between the Physical Practice and Control Groups and, as a result, the null hypothesis which stated that there would be no significant differences between the Physical, Mental and Control groups was rejected. The following chapter summarizes and discusses the results and suggests areas of study for future research.

Table 4. One-way Analysis of Covariance Comparing Mean Scores of the Physical, Mental and No Practice Groups

Source	df	SS	MS	F	p
Group	2	272.90	136.45	3.79	.029*
Residual	52	1871.22	35.98		

*Denotes significance at the .05 level.

Dependent Variable: Posttest

Covariate: Pretest

Table 5. Scheffe´ Test of Significance Comparing Mean Scores of Practice Groups

Group	Diff.	Crit. Diff.	p
CP vs. MP	4.31	4.90	.09
CP vs. PP	7.58	4.84	.001*
MP vs. PP	3.26	4.84	.24

*Denotes significance at the .05 level.

PP=Physical Practice
MP=Mental Practice
CP=Control Group (No Practice)

Chapter V

SUMMARY AND DISCUSSION

The purpose of this study was to determine the effectiveness of mental practice in improving the performance of pitch and rhythm patterns of sixth grade beginning band instrumentalists. Since the 1940s, several studies have investigated the effectiveness of mental practice on a variety of tasks such as the ring-toss, dart-throw, typewriting, Pacific Coast one-hand foul shot, volleyball, action-reaction start in swimming, gymnastics, a science lab experiment, and on the musical performance of college musicians. Some of these studies have concluded that mental practice is just as effective as physical practice in improving performance while other studies have concluded that mental practice is no more effective than no practice.

Perhaps the most important point brought out by the research on mental practice is that it's effectiveness varies from one task to another. This phenomenon is related, in part, to the complexity and type of task as well as the skill level of the person performing the task. Because of the contradictory results of these studies and because none of these studies had investigated the effectiveness of mental practice with young musicians it was the objective of this study to determine if mental practice is a viable means of improving the performance of pitch and rhythm patterns for sixth grade beginning band brass and woodwind players.

This study used a pretest-posttest-control group design. The Watkins/Farnum Performance Scale was used to measure the performance of

beginning band brass and woodwind instrumentalists under three different practice treatments: Mental Practice, Physical Practice and No Practice (control group). Subjects were taperecorded as they sightread selection #2 from form A of the Watkins/Farnum test for the pre-test. Subjects were then given selection #2 from from B of the Watkins/Farnum test and instructions according to which of the three practice treatments to which they had been assigned. After a three minute practice time students were recorded as they performed the selection for the posttest. A panel of three experienced music teachers served as judges and scored the tape recorded pretest and posttest performances on the basis of correct notes (pitch) and rhythm patterns.

The objective of the data analysis was to determine if physical, mental and no practice differed significantly in their effectiveness of improving performance for beginning band students. It was necessary to assume caution when interpreting the results of this study since the use of a mental practice condition potentially threatened the validity of the results. However, this is a problem with any research investigating unobservable behavior. While the researcher observed students in the mental practice treatment to insure that they did not use any physical movement to practice the music, it is virtually impossible to know exactly what each subject in this condition was thinking during mental practice. This chapter summarizes and discusses the results of the study in light of their practical application to music education. The first section summarizes the results of the data analysis and the second section offers suggestions for future research.

Summary of Findings

The primary finding of the study was that after a three minute practice session, students in the physical practice group scored significantly higher than those who did not practice. Because of this significant difference, the null hypothesis that there would be no difference in performance between mental, physical and no practice was rejected.

Further analysis revealed no significant difference between the Mental Practice and Physical Practice Groups. Therefore, there was no significant difference between mental and physical practice in improving performance of the subjects in this study. This finding is supported in studies by Twining (1949), Clark (1960), White and Lewis (1978), Mendoza and Wichman (1978), Beasley (1979) and Coffman (1991).

While there was not a significant difference between performance of the Mental Practice and Control Groups at the determined level of significance ($p<.05$), the probability of difference at less than .10 hints that differences may be revealed using larger samples. This finding is similar to that of the studies by Ross (1985) and Rosenthal, Wilson, Evans, and Greenwalt (1988) which found that mental practice was no more effective than no practice in improving musical performance.

Discussion

The objective of this study was to determine if mental practice is a viable means of improving the performance of pitch and rhythm patterns for sixth grade beginning band brass and woodwind players. The results of this

study indicate that mental practice can be used by young musicians to improve performance of pitch and rhythm patterns. In this study, performance of subjects in the mental practice treatment was not significantly different than that of those students in the physical practice treatment.

The results of this study suggest that further research is needed to determine more precisely the effectiveness of mental practice on the performance of young musicians. While the mental practice group was not significantly better than the control group which did not practice in this study, it is possible that the complexity of playing a musical instrument and young age of the subjects negated the effectiveness of mental practice. This observation is based on the results of several studies which have concluded that the value of mental practice may be specific to the type, complexity and skill level of the task being performed (Clark, 1960; Oxendine, 1969; Phipps and Morehouse, 1969; Schick, 1970; Ulich, 1967). For example, Clark found that novice athletes benefited more from physical practice while the advanced athletes benefited equally from mental and physical practice. In contrast, Schick found that that subjects with little volleyball skill benefited more from mental practice than those with advanced skills.

Future repetitions of this study are needed to substantiate the results of this experiment and to determine if mental practice is significantly more effective than no practice in improving performance for young musicians. Several studies (Ulich, 1967; White and Lewis, 1978; Ross, 1985) have concluded that physical practice combined with mental practice is more effective than physical practice alone. Therefore, future research with

beginning band students should be designed to compare the effectiveness of combined physical/mental practice and mental, physical and no practice alone.

It may be that the different performance techniques required of brass and woodwind instruments are affected differently by mental practice. Future studies should use a larger sample size to determine if brass and woodwind players differ in their performance under mental practice, physical practice, a combination of mental and physical practice, and no practice. Also, future studies should incorporate longer practice schedules. For example, instead of one 3 minute session as was used in this study, future studies could use a schedule of 5 minutes per day for 5 days. Finally, the research on mental practice should investigate the effects of mental practice on musical performance for students who are older and have more experience on their instruments (i.e. grades 7-12).

Although most instrumental music teachers require students to practice and in some cases to keep records of their practice time, there is seldom any mention from teachers on how to practice nor is information on proper practice techniques presented in the beginning band method books. Once the effectiveness of various practice techniques for young musicians are validated, colleges need to make potential music teachers aware of the importance in teaching these techniques to young instrumentalists. Ultimately, beginning band method books need to be revised to include information for students on how to utilize mental and physical practice to improve their performance.

APPENDICES

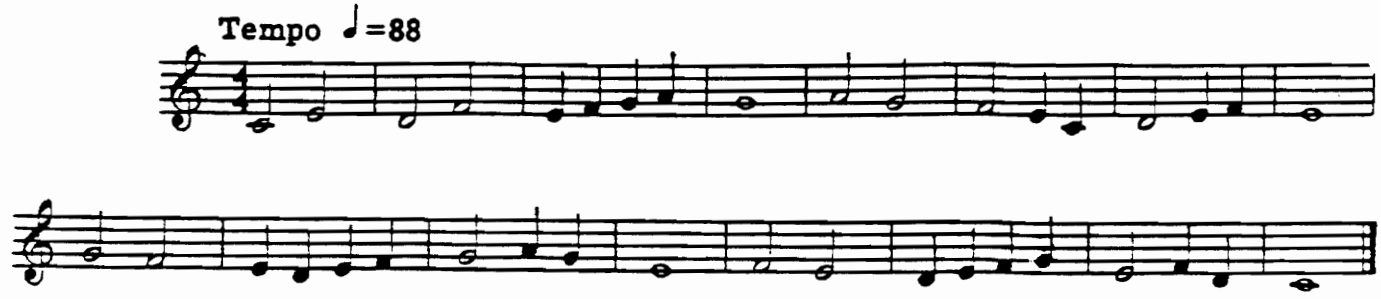
Appendix A

Key to
Subjects, ID numbers and treatment assignment

Instrument	Name	ID#	Treatment

Appendix B

Selection #2 from Form A of Watkins/Farnum Performance Scale



Appendix C

Posttest Instructions

Group 1—Mental practice

Try to Relax. Put your instrument down and try to feel comfortable in your chair. You are to mentally play both lines of selection number 2 of the music on your stand. Do not make any physical movements. Try to "hear" each pitch and rhythm in the music but do not sing them. Try to "feel"the movements of your embouchure but do not buzz your lips. Also, try to "feel" the movements of your valves or slide when change pitches, but do not move your arms or fingers. In 3 minutes I will ask you to play this music to the best of your ability. Do you have any questions?

Group 2—Physical practice

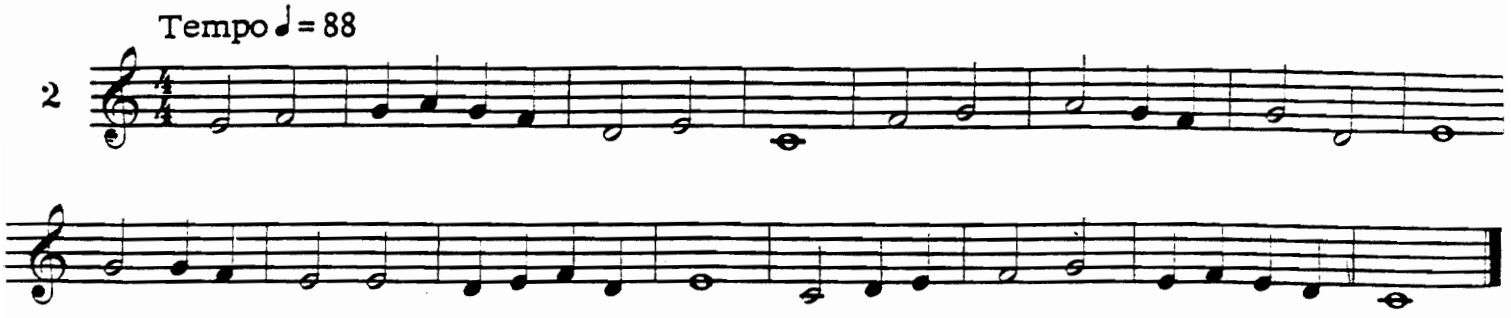
Please look at both lines of selection number 2 of the music on your stand and practice it continuously for the next 3 minutes. Do not stop and sing any of the song and do not attempt to practice the song by removing the horn from the embouchure and simulating the fingerings. Do you have any questions?

Group 3--Control group

"Please count backwards from 200 outloud". (After three minutes the student was asked to stop counting) "Please play both lines ofthe music on your stand to the best of your ability".

Appendix D

Selection #2 from Form B of The Watkins/Farnum Performance Scale



Appendix E

Instructions to Judges

1. Please look at the evaluation form. As each student performs on the tape you will here an ID #. Please write the ID# in the ID blank on the left side of the page.

2. Only pitch and rhythm errors will be scored. Only one error should be counted in any one measure. Pitch errors are defined as a tone added, omitted or played on the wrong pitch. If the student starts a note with a bad attack but recovers quickly then the note shall not be counted as an error. Any note not given it's correct value will be counted wrong. Sustained notes will be counted correct if the number of beats played is close to the value of the note. For example, a whole note played for 3 1/2 counts will be counted correct. As each musical selection plays make a "/" with your pencil for each incorrect measure.

Appendix F

Judge's evaluation form Judge's name________

ID #	score	total

Appendix E

Permission Form for Students

Dear Parent or Guardian:

I am currently working on my Master's Thesis at Virginia Tech and am conducting research on practice beginning band students. Students who participate in this study will be asked to practice and perform a short musical selection. Total time involvement for each student will be around 5 minutes. I would appreciate your cooperation in allowing your son/daughter to participate in this study.

Thank you,

Mr. Michael E. Pierson
Music Instructor
Lewisburg Intermediate School

Please sign below and return to Mr. Pierson

I give my permission for my son/daughter to participate in the beginning band study.

Student's Signature:_____

Parent's Signature:_____

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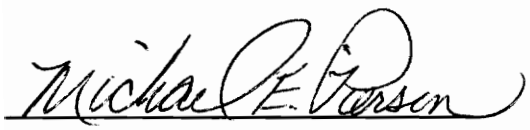
VITA

Michael Eldon Pierson was born in Richwood, West Virginia in 1964 and is the son of Larry and Charlotte Pierson of Lewisburg, West Virginia. Michael graduated from Greenbrier East High School in Lewisburg in 1983 and in 1987 received a Bachelor of Science in Music Education from Concord College in Athens, West Virginia. Since 1987 he has been employed as a music teacher in the Greenbrier County school system in Lewisburg, WV where he currently resides with his wife Christy, and son Braden. Michael remains active as a performing trombonist, is a member of the American Federation of Musicians local 674 in Covington, Virgina, the International Trombone Association, and has been employed as a trombonist with a house band at the famed Greenbrier Resort in White Sulphur Springs, WV since 1988. Michael received a Master of Science in Educational Curriculum and Instruction from Virginia Polytechnic Institue in 1992.



Michael Eldon Pierson