We tested 27 male and female high school band members performing solos under three levels of audience presence. Participants performed alone in a practice room, in a practice room with one researcher present, and in the rehearsal room with all researchers, a peer group, and a tape recording being made. Dependent measures were an analog scale self-report of perceived anxiety, heart rate recorded during performance, judges' rating of the final performance, and an exit interview. Self-reported anxiety rose with each succeeding performance condition, and each reported increase was significant. Heart rate was steady across the first two performance conditions, but rose significantly at the third. Female participants presented better performances, reported significantly higher anxiety levels than did males in the third performance condition, and attained significantly higher heart rates than did males in the first and third conditions. Gender emerged as a significant predictor of heart rate during performance, with female performers attaining higher heart rates.

Albert LeBlanc, *Michigan State University*

Young Chang Jin, *Michigan State University*

Mary Obert, *Lansing, Michigan*

Carolyn Siivola, *Michigan State University*

Effect of Audience on Music Performance Anxiety

Performance anxiety is a problem that has long hindered some musicians from reaching their full potentials as performers. Afflicting performers as disparate as concert pianist Vladimir Horowitz and pop singer Carly Simon, performance anxiety has also caused discomfort to generations of music students, their teachers, and their parents. It has been documented that musicians as successful as Leopold Godowsky (Nicholas, 1989), Enrico Caruso (Greenfeld, 1983), Pablo Casals (Kirk, 1974), and Maria Callas (Stassinopoulos, 1981) had to cope with notable problems of performance anxiety in building their careers.

We thank the students, parents, teachers, and administrators of the Okemos, Michigan, School District for their assistance in this study. We thank James Barry, Director of Bands, Okemos High School, for his advice and support. Albert LeBlanc is a professor of music in the School of Music, Michigan State University, East Lansing, MI 48824-1043. Young Chang Jin is a doctoral candidate in the School of Music, Michigan State University. Mary Obert is a private music teacher and can be contacted at 2428 Kuerbitz Road, Fowlerville, MI 48836. Carolyn Siivola is an instructor in the evening college, Michigan State University, and can be reached at 5756 Lowe Road, Fowlerville, MI 48836.

One of the most memorable stories of performance anxiety in music is related by Schonberg (1963) concerning the 19th-century pianist Adolf Henselt:

> When playing with an orchestra he would hide in the wings until the opening tutti was over, rush out and literally pounce on the piano. On one occasion he forgot to put aside the cigar he was nervously chomping—this was in Russia—and played the concerto cigar in mouth, smoking away, much to the amusement of the Czar. The mere thought of giving a concert made him physically ill. He gave very few throughout his career—far fewer than any of the great pianists, including Alkan—and in the last thirty-three years of his life apparently gave no more than three. (p. 199)

LeBlanc (1994) has advanced a formal theory that attempts to define, explain, and chart some possible interactions of variables that influence the level of performance anxiety an individual may experience while preparing and presenting a music performance that he or she considers important. LeBlanc's theory cites the presence and behavior of audience, authorities, educators, family, media, and peer group as important elements of the performing environment and as variables that can influence music performance anxiety. In this study, we sought to examine the effect of audience on the performance anxiety of high school band members as they played brief solo selections. We presented the effect of audience in a way that used authorities, educators, media, and peer group (each of these is a variable in the LeBlanc theory), and we designed the study so that the intensity of the audience experience would escalate across three solo performances. A secondary objective of our study was to explore possible gender differences in the response to an increasingly intense audience experience.

Some of the published studies of music performance anxiety have had limitations in their sample of participants, for example, working with males only, college students only, or college music majors only. This in turn limits the generalizability of these studies. In this study, we explored the effect of audience with male and female high school students, and we made a strong effort to recruit a true cross section of high school band members in the school in which we worked, rather than working only with the subset of highly motivated students that had already volunteered to enter solo festival.

Alvin Wardle's 1969 dissertation, completed at Florida State University, is the earliest experimental study we have found dealing with music performance anxiety. Although Wardle used a small audience of peers, observers, and researchers as part of his procedure, he did not manipulate the audience as one of his experimental variables. His focus was on different methods of treating performance anxiety.

In a nonmusic study, Cox (1968) found that the presence of an audience of fathers, male teachers, or male peers while fifth-grade boys were performing a challenging motor task was associated with better performance by low test-anxious boys but worse performance by high test-anxious boys.

Lund (1972) conducted the only study we found in which music performance anxiety with subjects younger than college age was examined. Lund's study was much like Wardle's, in which a small audience was used as part of the procedure, but the experimental focus was on contrasting methods of treating performance anxiety. Unlike Wardle, Lund took no physiological data.

Leglar (1978) worked with 30 organists who ranged in experience from undergraduate organ majors to postgraduate professionals. Her participants performed alone, in the presence of a critic, and in the presence of a critic and an audience of about 15 peers. Participant heart rates increased in the presence of a critic and again in the presence of a critic and a peer-group audience.

Abrams and Manstead (1981) studied 80 college students (40 men and 40 women) who performed under four conditions: alone, with two people present in an adjacent room, in front of a mirror, and for a tape recorder (with the tape to be evaluated later by a professor). Female participants made fewer performance errors, reported significantly more anxiety than did male participants, and attained significantly higher pulse rates than did the male subjects. Hamann (1982) worked with 90 (42 male and 48 female) college-level music majors who played alone with a tape recorder as a reduced-anxiety condition and for a peer-group and instructor audience as an enhanced-anxiety condition. Those performing for the peer-group and instructor audience reported significantly greater anxiety, and those with more years of formal study were judged to have presented better performances.

Hamann and Sobaje (1983) worked with 60 (25 male and 35 female) college music students who performed under conditions of enhanced anxiety (jury) and reduced anxiety (no jury). Participants reported significantly higher anxiety under jury conditions, and those with more years of formal study were judged to have presented better performances.

Abel and Larkin (1990) studied 22 (8 male and 14 female) college music students who were observed in a baseline laboratory session and again shortly before a jury performance. The heart rate and blood pressure of both genders was significantly higher before the jury performance than during baseline. Both genders had a significant increase in self-reported anxiety shortly before the jury, but the female-subject increase was significantly greater than that of the male subjects. On a one-item report of self-confidence, there was a significant interaction of gender and time of assessment, with male subjects reporting more confidence in the baseline session and female subjects reporting more confidence shortly before the jury.

Tartalone (1992) studied the physiological arousal and perceived state anxiety of 39 college music majors (27 men and 12 women) who were preparing for brass jury recitals. The researcher took data from four weeks before the jury, through dress rehearsal and actual performance. Blood pressure, heart rate, and respiration rate all showed a distinct rise at the time of dress rehearsal and again at the jury performance. The increases in blood pressure and heart rate were significant.

Self-reported anxiety increased significantly at dress rehearsal and on the morning of the jury, but not at the actual time of the jury performance. Participants with less jury playing experience generally showed a greater range of increase on all measures, and their rates were usually higher than those of the more experienced group immediately before the jury performance.

Brotons (1994) worked with 64 (32 males and 32 females) college music students who were measured practicing alone in a studio and again in either an open or a double-blind jury condition. The open jury was the regular jury condition. In the double-blind condition, subjects performed for an open jury and were also tape-recorded for later judging by external judges. Both heart rate and self-reported anxiety were significantly higher in the jury condition. There was no significant difference between the two types of jury condition.

This review of literature discloses a very consistent effect of audience, in which the presence of an audience is usually associated with significant increases in physiological arousal and self-reported anxiety in music performers. The role of gender in this response mechanism is somewhat less clear, and we found only one study done with music performers younger than college age.

METHOD

Participants

We worked with a sample of 27 male and female volunteer participants who were members of a local high school band. Grades 9 through 12 were represented, with 8 participants from Grade 9, 7 from Grade 10, 7 from Grade 11, and 5 from Grade 12. Sixteen participants were boys, and 11 were girls. Instruments represented in the sample included flute, oboe, clarinet, alto saxophone, tenor saxophone, baritone saxophone, trumpet, French horn, trombone, euphonium, tuba, snare drum, and orchestra bells.

Taking the band director's advice, we scheduled our study to begin a little more than 6 weeks before the date of district solo and ensemble festival. We hoped this would make participation in our study attractive to those who intended to perform a solo in the coming festival by offering them the opportunity to play for a music teacher who was unfamiliar to them and to play for an audience of their peers and several music teachers while a recording of their performance was being made. The latter experience would take place shortly before the date of the festival and would give participants an audience experience that would probably be more intense than that of the festival itself. We hoped that students would consider participation in our study to be a good way to prepare for festival. We were concerned, however, that tailoring our study to the needs of solo festival participants might result in our getting a self-selected and atypical sample: only those students who were good performers and who were most strongly motivated to enter a volunteer competition.

Materials

The band director had advised us that lack of a solo would be one of the main obstacles to participation in our study by students who did not already intend to enter the solo and ensemble festival. We therefore decided to furnish solos for participants who did not already have one, and we searched for a published collection of wind instrument solos that would be relatively easy and available for a wide variety of instruments. We had earlier considered standardizing the music to be performed by requiring a single selection to be played by all participants in the study, but we rejected this idea because we thought it would be unattractive to our participants, and it would require the peer-group audience to listen to the same selection many times.

After examining a number of possibilities, we selected a collection of songs from the musical *The Sound of Music* (Rodgers & Hammerstein, 1959) and identified a number of songs of highly comparable difficulty that we would allow participants to select if they did not already have a solo they wished to perform in our study. These songs were of a relatively easy difficulty level, and the band director assured us that they were within the reach of any student in the band. We bought enough copies of the collection so that every participant had printed music to take home and practice.

We designed an analog self-report scale, the Personal Performance Anxiety Report, which participants used immediately after each performance to tell us how much performance anxiety they had felt in the performance just completed. Instructions were printed on the scale, which was drawn in the shape of a mercury thermometer. By using this "thermometer," participants reported their perceived anxiety on a scale of 0 to 10, with higher numbers associated with greater anxiety.

We used two Polar Vantage XL heart-rate monitors to sample and accumulate each participant's heart rate during performance. This instrument is widely available in stores that cater to athletes and is primarily marketed as a device to facilitate the monitoring of exercise and athletic training programs. Its predecessor, the CIC Heartwatch, was field-tested by LeBlanc, Campbell, and Codding (1993) and found to be well accepted by participants in music research. The Polar Vantage XL was recently used in major studies of music performance anxiety by Brotons (1994) and Tartalone (1992). We recorded student performances on a Sony TC-FX6C stereo cassette recorder using Realistic 33-992 microphones.

Procedure

In our first visit to the band to explain the study, we described the heart-rate monitor that we would use to record participant heart rates. We also described this instrument in the letter requesting informed consent that we sent home to parents so participants had little apprehension about the monitor when it was time to begin the study.

Participants were allowed to select their own music to perform. The band director verified that no solo being used was too difficult for the ability level of the student performing it. Participants who did not have their own solos were allowed to select one of the songs we had approved from The Sound of Music. We noted that the participants who supplied their own music generally selected more difficult music.

We made every effort to ensure that participants prepared their solos in conditions that were ordinary for them. The band director made himself available to help any student who desired his help. Students were free to devote as much or as little practice to the solos as they wished. No student was required to perform from memory, and no student chose to do so.

All testing was done during band rehearsal in the choral rehearsal room adjoining the band room. Although normal clothing could be worn over it, it was necessary for the sensor belt of the heart rate monitor to directly contact the skin of a participant's chest in order to record an accurate heart rate. To protect the personal privacy of our participants, we arranged for them to use a private and windowless room to put on the sensor belt. We commissioned a professional graphic artist to draw illustrations showing correct wearing of the monitor's sensor belt and transmitter unit, and a copy of these illustrations together with a simplified set of instructions was provided to participants as they entered the dressing room. Participants had no difficulty putting on the sensor belt correctly.

The receiver unit of the Polar Vantage XL looks like a large wrist watch, and it is normally worn on the wrist, but we needed to touch the controls of the receiver to enter an event marker immediately before each participant began to play, and we were afraid this would create a distraction if the unit were strapped to the participant's wrist. We therefore bought two military-style adjustable belts and hung a receiver unit from each belt. Participants wore the belts and it was easy for one of the researchers to check the monitor and enter event signals without disturbing the participant, who would have both hands on the instrument in playing position at the time the signal needed to be entered. We field-tested this procedure before the actual study to verify that the receiver would still be within practical range of the transmitter unit mounted on the sensor belt.

In our first performance condition, participants wore the heart-rate monitor while performing the first 2 minutes of their solos alone in a practice room. In this and in every performance condition, the monitor was set to sample and record heart rate at 5-second intervals. This yielded 24 measurements of each participant's heart rate under each performance condition. Immediately after the 2-minute performance, each participant was brought to an adjoining practice room where he or she filled out a Personal Performance Anxiety Report. This procedure was repeated in every performance condition.

Our second performance condition required participants to play the first 2 minutes of their solo in a practice room with one of the researchers present. This performance took place 2 weeks after the first one.

Our third performance condition required participants to play the first 2 minutes of their solo in the choral rehearsal room with the four researchers and a small peer-group audience present. The peer-group audience ranged in size from 9 to 16 members and was entirely made up of other participants in the study. This performance was also tape-recorded by the researchers. Immediately after completing their solo and Personal Performance Anxiety Report, participants were brought into another room for a brief exit interview, conducted by a university student who had not been involved in the study up to this point. In the exit interview, participants were asked to identify which performance condition had been the most stressful and the second most stressful for them, and they were invited to make any comments they might wish to make.

Participants presented their third performance 2 weeks after their second one. Recordings of the participants' third performances were later judged by the four researchers, who assigned each performance a score ranging from 1 to 10, with a higher number indicating a better performance.

RESULTS

Reliability

Reliability of an earlier version of our heart rate monitor was assessed by Leger and Thivierge (1988), who obtained correlations of .95, .95, and .97 between the monitor and a simultaneously recorded electrocardiogram taken during step-test, treadmill, and bicycle-ergometer exercise, respectively. We measured the reliability of our music performance scores by computing coefficient alpha across the four judges. We obtained an alpha of .96 and considered it satisfactory.

Personal Performance Anxiety Report

Table 1 presents results of the anxiety self-report and heart-rate monitor for combined genders. The anxiety self-report shows a steady climb toward higher levels of anxiety in each succeeding performance condition, with self-reported anxiety highest in the third condition, in which participants played for all the researchers and a peer-group audience. Figure 1 presents the means of the anxiety self-report as a line graph.

We conducted a repeated measures analysis of variance using SPSS Subprogram MANOVA to test for significant differences in anxiety self-report scores across the three performance conditions, computing orthogonal difference contrasts. We used an alpha level of .05 for all significance tests. The first contrast compared the means of the first and second performance conditions, and was significant, F (1, 26) = 12.87, p = .0014. The second contrast compared the mean of the first and second conditions with the mean of the third condition, and was significant, F (1, 26) = 31.94, p = .00001. The effect of audience as represented by the three performance conditions was highly significant, as

Table 1
Mean Scores on Personal Performance Anxiety Report and Heart-Rate Monitor

Performing condition	Mean	*SD*
Personal Performance Anxiety Report		
1	2.04	1.60
2	3.33	1.80
3	5.11	2.33
Heart-rate monitor		
1	109.19	21.34
2	109.04	18.95
3	116.72	22.15

Note. There were 27 participants in the study. Higher scores indicate more anxiety and a faster heart rate.

reflected in the Personal Performance Anxiety Report (see Table 2).

Heart-Rate Monitor

The mean heart rate of our participants was virtually identical in the first two performance conditions, but there was a distinct rise in heart rate in the third condition, as shown in Table 1 and Figure 2. Again, we computed orthogonal difference contrasts. The contrast between the first two performance conditions was not significant, F (1, 26) = .0029, p = .9575. The second contrast, comparing the mean of the first and second conditions with the mean of the third condition, was signifi

Table 2
Orthogonal Contrasts for Personal Performance Anxiety Report

	First contrast	Second contrast
Hypothesis SS	22.68	105.93
Error SS	45.82	86.24
Hypothesis MS	22.68	105.93
Error MS	1.76	3.32
F	12.87	31.94
p	.001	.000
Eta squared	.33	.55

Note. The first contrast compared the means of the first and second performance conditions. The second contrast compared the mean of the first and second performance conditions with the mean of the third performance condition. SS = sum of squares; MS = mean square.

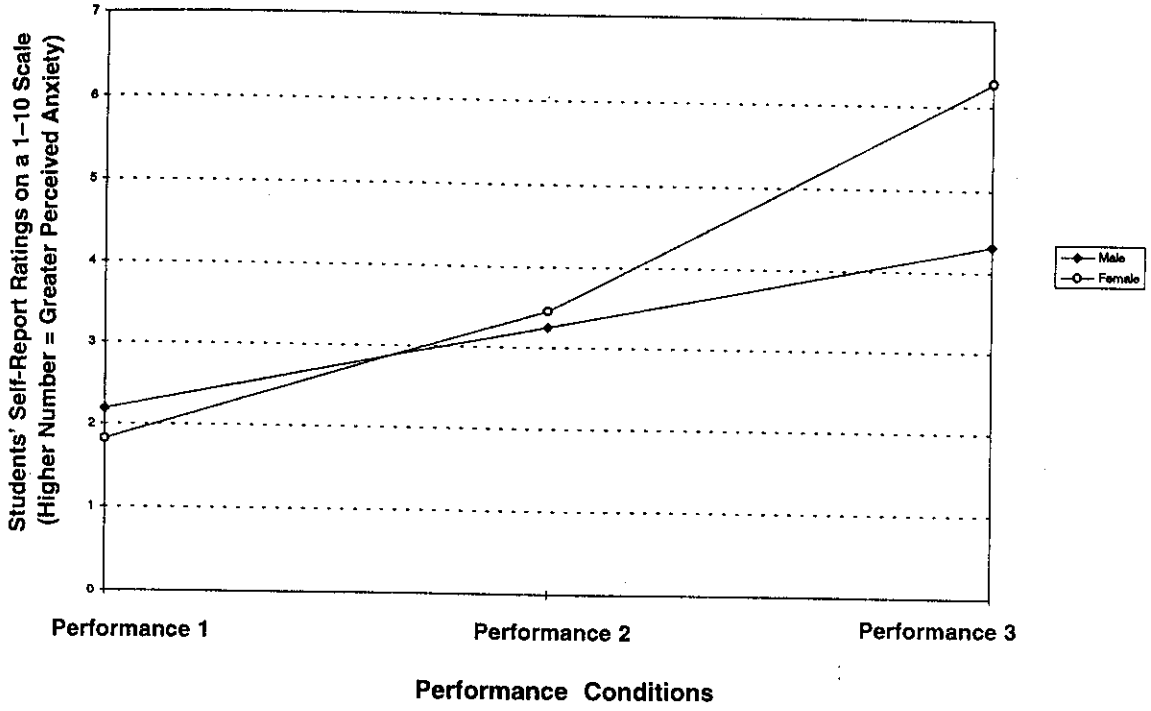

Figure 1. Mean Personal Performance Anxiety Report in three performance conditions.

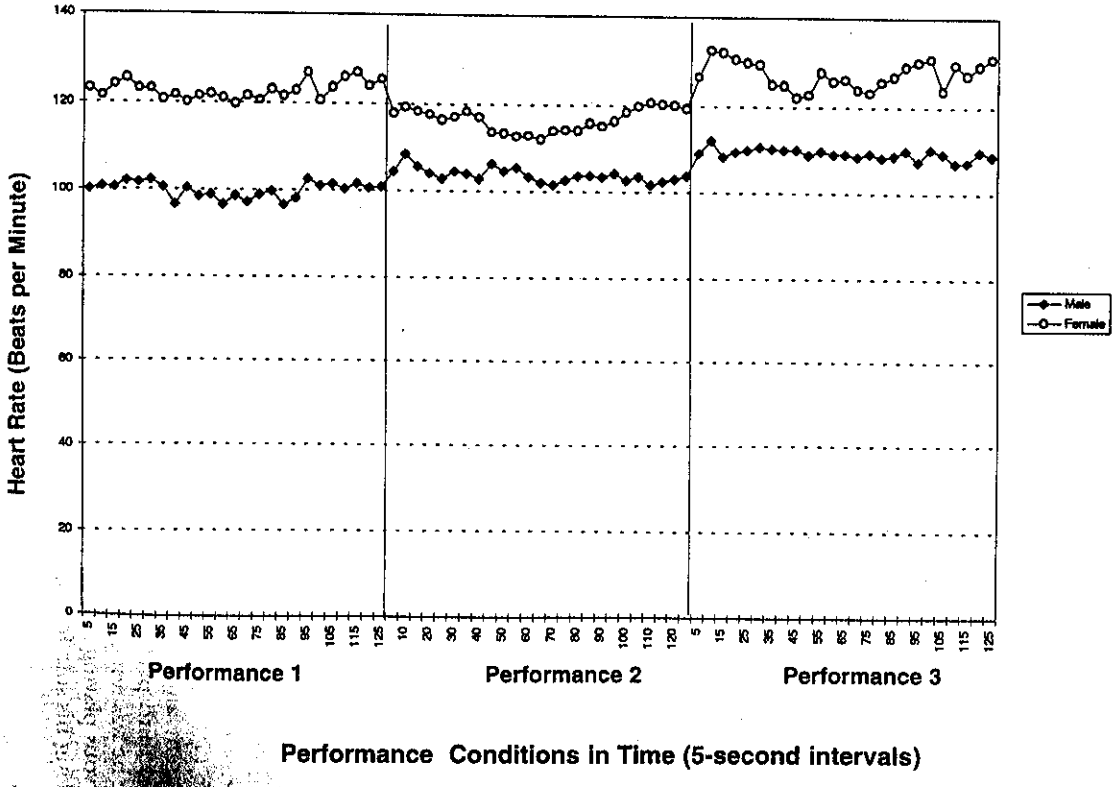

Figure 2. Mean heart rate in three performance conditions.

Table 3
Orthogonal Contrasts for Heart-Rate Monitor

	First contrast	Second contrast
Hypothesis SS	0.31	1041.71
Error SS	2763.37	6038.52
Hypothesis MS	0.31	1041.71
Error MS	106.28	232.25
F	0.00	4.48
p	.957	.044
Eta squared	.00	.15

Note. The first contrast compared the means of the first and second performance conditions. The second contrast compared the mean of the first and second performance conditions with the mean of the third performance condition. SS = sum of squares; MS = mean square.

cant, $F(1,26) = 4.48$, $p = .0439$. As reflected by heart rate, the effect of audience was significant only with the audience that was composed of the peer group and the researchers (see Table 3).

Exit Interview

In the exit interview, 17 students (63% of the group) said that playing for the researchers and the peer group was the most stressful performance condition, while 8 (30%) said playing for one researcher in a practice room was most stressful, and 2 (7%) said playing alone in a practice room was most stressful.

At the conclusion of the exit interview, participants were asked if they had any general comments to offer. The most prominent comment, made by 5 participants (18% of the group), was that they were most anxious when playing for a group of classmates and friends. One said "It is nerve-racking to play for your friends, but if you can play for your friends, you can play for anybody." Three (11%) said they were not worried because the music was easy, three said it was fun to participate, two (7%) said they would be more nervous if their band director were present, and two said they did not realize they were being recorded in the third performance condition. One said he was not nervous because he was not playing for a festival rating, and another said he was not nervous playing for his classmates because it was the third time he was playing his solo for this study.

Results by Gender

A secondary purpose of our study was to investigate the effect of audience on music performance anxiety by gender to see if the genders might have different patterns of response to different levels of audience effect. Table 4 presents the results of the anxiety self-report, the

Table 4
Mean Scores on Personal Performance Anxiety Report, Heart-Rate Monitor, and Performance Rating by Gender

Performing condition	Gender	Mean	*SD*
Personal Performance Anxiety Report			
1	M	2.19	1.56
1	F	1.82	1.72
2	M	3.25	1.92
2	F	3.45	1.70
3*	M	4.31	2.02
3*	F	6.27	2.33
Heart-rate monitor			
1**	M	99.83	18.50
1**	F	122.81	18.06
2	M	103.84	14.61
2	F	116.60	22.52
3*	M	109.32	21.56
3*	F	127.50	19.04
Performance rating			
3**	M	5.70	2.46
3**	F	8.20	1.07

Note. There were 16 male and 11 female participants in the study. On the first two measures, higher scores indicate more anxiety and a faster heart rate. The performance rating ranged from 1 to 10, with a higher score indicating a better performance. Asterisks indicate a performing condition in which there was a significant difference between genders: * for alpha = .05, and ** for alpha = .01.

heart-rate monitor, and the performance rating by gender. It should be noted that 16 of our participants were male and 11 were female.

Responses by the two genders were fairly similar in the Personal Performance Anxiety Report until the third performance condition, when female participants reported considerably more anxiety. This difference was significant in a one-way analysis of variance, $F(1, 25) = 5.42$, $p = .0283$. We used one-way analyses of variance (ANOVAs) for all significance tests between genders.

Female participants displayed markedly higher heart rates in the first performance condition, and this was significant, yielding $F(1, 25) = 10.25$, $p = .0037$. Female heart rates remained higher in the second condition, but this difference did not attain significance, $F(1, 25) = 3.21$, $p = .0854$. Female heart rates were markedly higher in the third performance condition, and this was significant, $F(1, 25) = 5.08$, $p = .0332$.

Female participants received a markedly higher mean performance rating than did males, and the standard deviation of female performance ratings was less than half that of the males. The higher perfor-

Table 5
Simple and Partial Correlations

Variable(s) controlled	Variables correlated
	Music selection and performance quality
—	.58**
Gender	.47**
Grade	.56**
Gender and grade	.45*
	Gender and performance quality
—	.53**
Grade	.53**
Music selection	.39*
Grade and music selection	.41*
	Grade and performance quality
—	.35
Gender	.36
Music selection	.31
Gender and music selection	.33

Note. Asterisks indicate significant correlations: * for alpha = .05, and ** for alpha = .01.

mance rating for females was significant, F (1, 25) = 9.95, p = .0042. However, we have reason to believe that the effect of gender was mingled with the effect of music selection (using our music versus the participant's own music) in this study. Among female participants, 9 (82%) used their own music while 2 (18%) used ours. Among male participants, 5 (31%) used their own music while 11 (69%) used our music. This inclination of females to use their own music and of males to use our music was statistically significant beyond the .01 level, chi-square = 7.22, df = 3.

Correlation Analysis

Table 5 presents simple and partial correlations involving gender, grade, music selection, and performance quality. The correlation between music selection and performance quality remained strong and statistically significant no matter which of the other variables was statistically controlled. Those who used their own music presented the better performances. Gender had a strong and statistically significant relationship to performance quality, but it fell from .53 to .39 when the

effect of music selection was controlled. Female participants presented the better performances. The effect of grade (.35) had a comparatively strong relationship to performance quality, though it did not attain significance. It was reduced only slightly by the statistical control of other variables. Participants in higher grades presented the better performances.

Regression Analysis

We pooled the heart rate scores from all three performance conditions and entered music selection, participant grade, participant gender, and performance score into a simultaneous multiple-regression equation to predict heart rate. A squared multiple correlation of .27 indicated that these four predictors accounted for 27% of heart-rate variance. Of these four predictors, gender was by far the strongest, with a beta weight of .53, and it was the only significant predictor, t (22) = 2.41, p = .0249 (see Table 6). If performance anxiety is operationalized as obtained heart rate, gender was the best predictor, with female participants attaining higher heart rates during performance. To further check the effect of music selection on heart rate, we entered it as the lone predictor of heart rate in a regression equation. Music selection accounted for less than 1% of the variance in heart rate, attained a beta weight of .09, and was not a significant predictor, t (25) = 0.45, p = .6550.

We pooled the scores on the Personal Performance Anxiety Report across all three performances and entered performance score, heart rate, participant grade, music selection, and participant gender into a simultaneous multiple-regression equation to predict the anxiety score. These variables accounted for 24% of the variance in the anxiety scores, and heart rate emerged as the strongest predictor with a beta weight of .39 (see Table 7). However, it failed to attain significance, t (21) = 1.76, p = .0933. The fact that obtained heart rate was the strongest predictor of the Personal Performance Anxiety Report speaks

Table 6
Summary of Simultaneous Regression Analysis for Variables Predicting Heart Rate (N = 27)

Variable	*B*	SE *B*	*Beta*
Gender	18.89	7.85	.53*
Grade	–.15	3.17	–.01
Performance score	.66	1.98	.09
Music selection	–6.12	7.98	–.17

*p > .05.

Note. *B* = partial regression coefficient; SE *B* = standard error of the partial coefficient; *Beta* = standardized beta coefficient.

Table 7
Summary of Simultaneous Regression Analysis for Variables Predicting Personal Performance Anxiety Report (N = 27)

Variable	*B*	SE *B*	*Beta*
Music selection	.59	.67	.21
Heart rate	.03	.02	.39
Gender	−.04	.74	−.01
Grade	−.34	.26	−.27
Performance score	−.04	.16	−.07

Note. *B* = partial regression coefficient; SE *B* = standard error of the partial coefficient; *Beta* = standardized beta coefficient.

well for the validity of the self-report measure. We removed heart rate from the regression equation to evaluate the predictive power of the remaining variables and noted that the remaining variables accounted for only 12% of the variance in the anxiety score. Grade emerged as the strongest predictor with a beta weight of −.27. It was not significant, $t(22) = -1.25$, $p = .2234$. The negative beta weight indicated that participants in higher grades reported lower anxiety.

DISCUSSION

This study tended to confirm the findings of earlier work done with older participants. The presence of an audience was associated with greater performance anxiety, as it had been in studies by Leglar (1978), Hamann (1982), Hamann and Sobaje (1983), Abel and Larkin (1990), Tartalone (1992), and Brotons (1994). Female participants experienced greater anxiety, as they had in studies by Abrams and Manstead (1981) and Abel and Larkin (1990), and they presented performances that were musically better, as they had in the 1981 study by Abrams and Manstead.

We were surprised by the fact that participants reported anxiety over the task of playing alone in a practice room. It might seem incongruous that playing alone could have been viewed as the most stressful condition, but it should be noted that this was the first time that participants wore the heart-rate monitor, all the practice rooms had glass walls, and access to the practice rooms could be had only from a narrow balcony, so the researchers and several other participants remained close by on the balcony waiting for the next available practice room while participants were playing their solos. This situation made the first performance condition more of an audience experience than we had expected it to be when planning the study.

We were also surprised that the effect of music selection was so powerfully associated with performance quality. Seeking to explain this effect, we hypothesized that those who used their own music were more

likely to have been taking private music lessons and to have been planning to enter solo festival. This would have made them more motivated to excel, and it also would have made their performances in our study more important to them.

Implications for Music Education

This study suggests the following implications for music education:

1. The audience, even a small peer group, was associated here with a significant increase in the anxiety of high school musicians who performed for it. Music teachers should be aware of the potential for stress in performing for an audience, and they should try to prepare their students for the audience experience in a way that will minimize student anxiety.

2. There is reason to believe that the two genders may respond differently to stressful conditions of performance. In our study, female participants reported significantly higher anxiety levels in the third performance condition, and they attained significantly higher levels of heart rate in the first and third performance conditions. Music teachers should be particularly sensitive to the needs of female students when they are exposed to potentially stressful performance conditions. The LeBlanc (1994) theory of music performance anxiety may be helpful to music teachers in structuring an environment in which excessive anxiety can be prevented or controlled.

Suggestions for Future Research

It would be desirable to focus specifically upon the responses of the two genders to stressful performance conditions. Researchers who conduct such studies should attempt to enroll equal numbers of participants from the two genders and to control for variables such as difficulty of music, level of participant motivation, and years of formal music study. They should also plan their studies to give participants a generous time allowance for trying out any physiological measuring equipment while they are playing their solo. No physiological data should be taken during the trial period. The present study was limited by its comparatively small number of participants, and it would be desirable to work with larger numbers in future research in this area.

REFERENCES

Abel, J. L., & Larkin, K. T. (1990). Anticipation of performance among musicians: Physiological arousal, confidence, and state anxiety. *Psychology of Music, 18,* 171–182.

Abrams, D., & Manstead, A. S. (1981). A test of theories of social facilitation using a musical task. *British Journal of Social Psychology, 20,* 271–278.

Brotons, M. (1994). Effects of performing conditions on music performance anxiety and performance quality. *Journal of Music Therapy, 31,* 63–81.

Cox, F. N. (1968). Some relationships between test anxiety, presence or absence of male persons, and boys' performance on a repetitive motor task. *Journal*

of Experimental Child Psychology, 6, 1–12.
Greenfeld, H. (1983). *Caruso.* New York: Putnam.
Hamann, D. L. (1982). An assessment of anxiety in instrumental and vocal performances. *Journal of Research in Music Education, 30,* 77–90.
Hamann, D. L., & Sobaje, M. (1983). Anxiety and the college musician: A study of performance conditions and subject variables. *Psychology of Music, 11,* 37–50.
Kirk, H. L. (1974). *Pablo Casals.* New York: Holt, Rinehart & Winston.
LeBlanc, A. (1994). A theory of music performance anxiety. *The Quarterly Journal of Music Teaching and Learning, 5,* 60–68.
LeBlanc, A., Campbell, P. S., & Codding, P. (1993). Suitability of a personal heart rate monitor for use in music research. *Missouri Journal of Research in Music Education, 30,* 38–52.
Leger, L., & Thivierge, M. (1988). Heart rate monitors: Validity, stability, and functionality. *The Physician and Sports Medicine, 16* (5), 143–151.
Leglar, M. A. (1978). Measurement of indicators of anxiety levels under varying conditions of musical performance. *Dissertation Abstracts International, 39,* 5201A-5202A. (University Microfilms No. 79-06734)
Lund, D. R. (1972). A comparative study of three therapeutic techniques in the modification of anxiety behavior in instrumental music performance. *Dissertation Abstracts International, 33,* 1189A. (University Microfilms No. 72-23,026)
Nicholas, J. (1989). *Godowsky: The pianists' pianist.* Wark, Hexham, Northumberland, Great Britain: Appian.
Rogers, R., & Hammerstein, O., II. (1959). *The sound of music* [Score]. New York: Williamson.
Schonberg, H. C. (1963). *The great pianists.* New York: Simon & Schuster.
Stassinopoulos, A. (1981). *Maria Callas: The woman behind the legend.* New York: Holt, Rinehart, & Winston.
Tartalone, P. M. (1992). Patterns of performance anxiety among university musicians preparing for brass area jury recitals: Physiological arousal and perceived state anxiety. *Dissertation Abstracts International, 54,* 24A.
Wardle, A. (1969). Behavioral modification by reciprocal inhibition of instrumental music performance anxiety. *Dissertation Abstracts International, 31,* 793A. (University Microfilms No. 70-11, 171)

Submitted October 25, 1995; accepted June 25, 1996.

Corrections/Announcements

The corrections on this and the following page apply to two articles published in the Spring 1997 issue of the *Journal of Research of Music Education.* The first was written by Ruth V. Brittain and Robert A. Duke and titled "Continuous versus Summative Evaluations of Musical Intensity: A Comparison of Two Methods for Measuring Overall Effect." The figure, corrected here, appeared on p. 253.

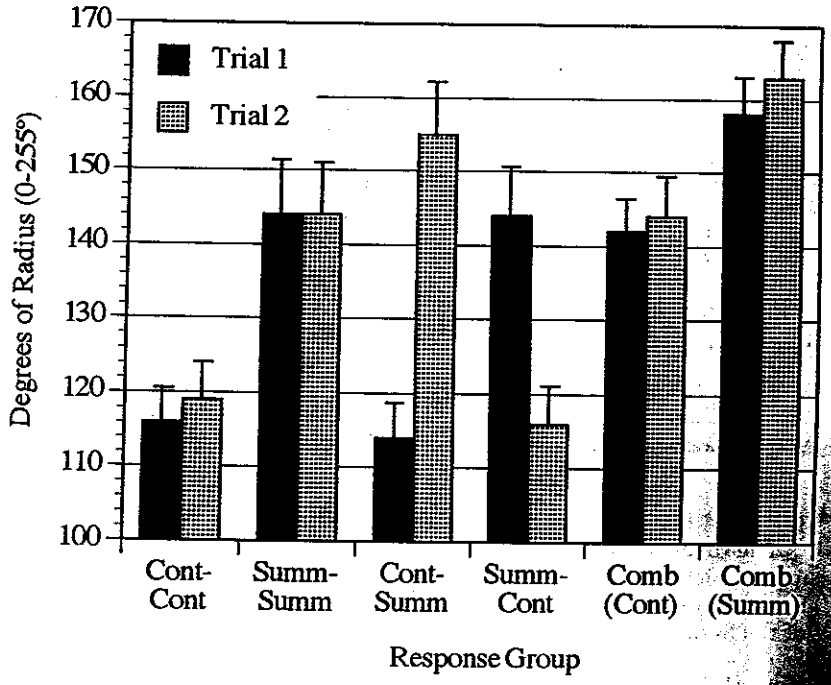

Figure 1. Interaction means for Response Condition by Trial interaction.

* * * * * * * * * *